THE JOURNAL

OF THE

BOARD OF ARTS AND MANUFACTURES

FOR

UPPER CANADA.

EDITED BY HENRY YOULE HIND, ESQ., M. A., F.R.G.S.

(PROFESSOR OF CHEMISTRY AND GEOLOGY IN THE UNIVERSITY OF TRINITY COLLEGE.

VOLUME I.

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BOARD OF ARTS AND MANUFACTURES FOR UPPER CANADA,

FOR THE YEAR 1861.

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THE JOURNAL

OF THE

Board of Arts and Manufactures

FOR UPPER CANADA.

JANUARY, 1861.

INTRODUCTION.

It is presumed to be unnecessary to discuss in the pages of this journal, the importance of affording encouragement and aid to manufacturing Industry throughout the Province. Government has recognized the principle involved in the support of Home Industry by establishing Boards of Arts and Manufactures, and defining their duties. One comprehensive paragraph in the Act, "*To make better provision for the* ENCOURAGEMENT *of* AGRICULTURE, *and to* PROVIDE *for the* PROMOTION *of* MECHANICAL SCIENCE," instructs them to "adopt every means in their power to promote improvement in the mechanical arts and in manufactures in the Province." The first efforts of the Board for Upper Canada are necessarily limited by its pecuniary position, and while it must for some years be dependent upon public aid, yet its organization is so framed that means and opportunities to fulfil the duties imposed by law, will expand and gain strength with the objects of its care.

The establishment of a Museum embracing raw and manufactured materials, models of works of art, implements and machines employed in manufacturing processes, the formation of a Free Library of Reference and the introduction of new and improved implements and machines from other countries, are in themselves important and extensive duties; but, in addition to these the Board is empowered to establish in connection with the Museum, a Model room, a School of Design for Females, and a School for Mechanics, and to employ competent persons to deliver lectures connected with the Mechanical Arts and Sciences, or with manufactures.

While thus defining the duties of the Boards of Upper and Lower Canada in the exercise of a beneficial, and probably also a highly important and powerful influence upon the progress of Industry in the Province, the originators of this project have had in view the steps which were taken in Europe some years ago, to further the same object there. Next to the absence of capital, a want of skilled artizans and intelligent manufacturers, educated in the details of their special branches of Industry, has always proved the greatest drawback to steady progressive advancement.

In the mother country, the Committee of Council on Education has a Science and Art Department, whose members report annually on their proceedings. The last report of the Department (1860) relates to:—

I.—Aid afforded to the Industrial classes in obtaining Instruction in those branches of Science and Art *which have a direct bearing on their occupations.*

II.—The administration of the South Kensington Museum as the Central repository for examples in different branches of Science and Art, which as far as may be practicable are made available for the benefit of the United Kingdom and are circulated to provincial schools.

III.—Institutions for the promotion of Science and Art, subject to the superintendence of the department.

It will not escape notice that this report touches upon the most important of those objects which it is the duty of the Boards of Arts and Manufactures in Canada, to promote "by every means in their power." So encouraging are the results obtained in the United Kingdom, that an enumeration of some of them which approximate closely to what it is desirable to secure in Canada, will be both instructive and appropriate.

In 1852–3, twenty-three Schools of Design, with 6,997 students, now re-formed into Schools of Art, cost an average of £2 11s. for each student; in 1858, seventy-eight Schools of Art, completely organized and containing 80,000 students, were sustained at an average cost of 9s. 3d. per student, or about one-seventh of the cost in 1851.

Great success has attended the circulation of objects of Art among the Art Schools of the United Kingdom. A travelling collection during the last three years has been sent to 26 places and visited by 306,907 persons, realizing to the funds of the Art Schools, £6,011. Although the most fragile articles, such as Sèvres procelain, and glass, were transmitted at least 3,690 miles by railway, and were packed and unpacked 56 times, no specimens were broken or damaged. The Committee on Education consider that this experiment has shown that the use of national property in works of Art may be extended to all parts of the United Kingdom, and that the system should be revised, enlarged, and made as self-supporting as possible.

The South Kensington Museum, built upon the estate purchased with the surplus funds derived from the great Exhibition of 1851, is a splendid illustration of British energy, talent, and skill, exerted in favour of manufacturing industry. The collections consist of objects of ornamental art, an Architectural Museum, a Trade Museum, a court of Modern Sculpture, a Government Educational Collection, a gallery of British Art, &c., &c., &c. A novel feature in this Museum is the System of Loans, whereby the public taste is greatly encouraged and promoted. Public institutions and private individuals *loan* their collections to be exhibited in

this Museum, and permit the different objects to be photographed and copies sold at cost price. The number of persons visiting the South Kensington Museum in 1859 amounted to 475,365. Among its most interesting and important collections are the Animal Products, Food Collections, and the Building Materials. The appeal made to the public by the Superintendent of the Food and Animal Collections, may be appropriately introduced here. "To this department of our Museum I would especially invite the attention of that great class of manufacturers in our country, who are engaged in the production of the commodities of life from animal substances, requesting for *their own sakes* and for the sake of the advancement of the industrial interests of the country, that they will assist in carrying out the great objects of this collection, by contributing specimens of the processes and goods which they manufacture. There is no more worthy object of national pride and ambition than the scientific exhibition of the materials and products of that industry on which the physical greatness of our nation depends."

The Museum of the Board for Upper Canada is at present limited to Models of Patents. The organization of a department is in contemplation, designed to exhibit improved manufacturing processes throughout their different stages, from the crude or raw material to the highest attainable result in all its various details. The other departments of a general Museum of Art and Industry have been already organized by the Chief Superintendent of Schools, with a view to a School of Art, for which the preparations are now completed in the Normal School Buildings at Toronto. These adjuncts to our educational system will relieve the Board of an expensive and difficult undertaking, and will be no doubt efficiently carried out under the able direction of the Chief Superintendent. The steps which have been taken in furtherance of this project are given below.*

A Free Library of Reference, devoted exclusively to works relating to Manufacturing Industry in all its branches and details, is being gradually formed, and a programme is given on a subsequent page of the periodical examinations of members of Mechanics' Institutes and others who may become candidates for the certificates of the Board. Finally the Board has commenced the issue of this Journal, the object and plan of which are so fully given in the Prospectus that no further allusion to it is necessary.

France, Germany, and Belgium have been long distinguished for the care and activity displayed by their respective governments in providing schools for special branches of industry, and for placing the means of acquiring a knowledge of all kinds of handicraft or improved manufacturing processes within reach of every one. The utmost solicitude and attention have been devoted in times of peace, during late years, to the industrial training schools, and every encouragement has been given to the introduction of improved processes or the discovery of more economical methods of arriving at a given result.

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* *Annual Report of the Normal, Model, Grammar and Common Schools in Upper Canada, for the year* 1859—*by the Chief Superintendent of Schools.*

THE EDUCATIONAL MUSEUM.

This Educational Museum is founded after the example of what is being done by the Imperial Government as part of the system of popular education—regarding the indirect as scarcely secondary to the direct means of training the minds and forming the taste and character of the people.† It consists of a collection of school apparatus for Common and Grammar Schools, of models of agricultural and other implements, of specimens of the natural history of the country, casts of antique and modern statues and busts, &c., selected from the principal museums of Europe, including busts of some of the most celebrated characters in English and French history; also copies of some of the works of the great masters of the Dutch, Flemish, Spanish, and especially of the Italian schools of painting. These objects of art are labeled, for the information of those who are not familiar with the originals, but a descriptive historical catalogue of them is in course of preparation. In the evidence given before the Select Committee of the British House of Commons, it is justly stated, "that the object of a National Gallery is to improve the public taste, and afford a more refined description of enjoyment to the mass of the people; and the opinion is, at the same time, strongly expressed, that as "people of taste going to Italy constantly bring home beautiful modern copies of beautiful originals," it is desirable even in England, that those who have not the opportunity or means of travelling abroad, should be enabled to see, in the form of an accurate copy, some of the celebrated works of Raffaelle and other great masters; an object no less desirable in Canada than in England. What has been thus far done in this branch of public instruction, is in part the result of a small annual sum, which, by the liberality of the Legislature, has been placed at the disposal of the Chief Superintendent of Education, out of the Upper Canada share of school grants, for the purpose of improving school architecture and appliances, and to promote arts, science and literature by means of models, objects and publications, collected in a Museum, in connection with this department.

The more extensive Educational Museum at South Kensington, London, established at great expense by the Committee of Her Majesty's Privy Council of Education, appears, from successive Reports, to be exerting a very salutary influence, while the School of Art connected with it is imparting instruction to hundreds, in drawing, painting, modeling, &c. A large portion of the contents of our Museum has been procured with a view to the School of Art, which has not yet been established, though the preparations for it are completed. But the Museum has been found a valuable auxiliary to the Schools; the number of visitors from all parts of the country, as well as from abroad, has greatly increased during the year, though considerable before; many have repeated their visits again and again; and I believe the influence of the Museum quite corresponds with what is said of that of the Educational Museum in London.

† See my Annual Report for 1857, in which there is a full detail of what is done in England in this respect.

The effect of this solicitude has been very marked in elevating the condition of the artizan, enriching the manufacturer, and swelling the coffers of the State. But most striking does the result appear to be when comparisons are instituted between the condition of those countries in which Industry is encouraged and educated, and those where it is left unaided, or neglected altogether. No doubt the natural resources of a country play a very important part in its progress in the industrial arts. The United Kingdom would occupy a far different position in the scale of nations if coal and iron had not been abundant and easily accessible, for it is only of late years that the powerful influence of government has been directed to the special education of the industrial classes. The people have elevated themselves by their innate genius and enterprise without external aid, yet while they stand preëminent in mechanical contrivances and in the more useful products of industry, yet, in the arts generally, they are outstripped by the specially educated continental manufacturer and artizan.

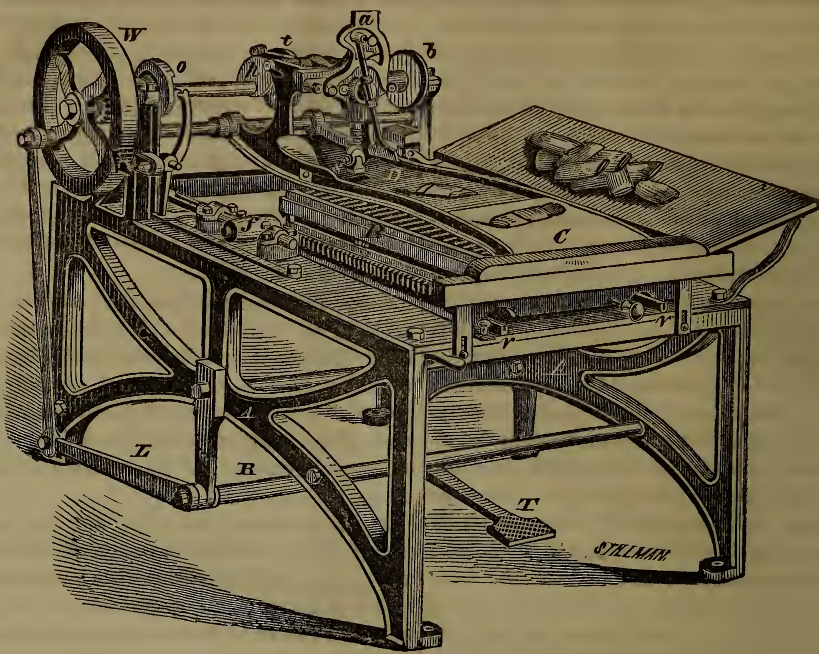
In future articles the condition of Industry in Europe will be described, and the beneficial influences made manifest which have arisen from a knowledge of the practice and progress of other countries being brought within the reach of the Industrial classes, whether by Training Schools, Industrial Schools, Model rooms, Museums, Journals or lectures. The genius and circumstances of a people determine which of the preceding aids to improvement are best adapted to their wants.

Canada is a producing and consuming, but comparatively not yet a manufacturing country. The exports in 1857 amounted to twenty-seven million dollars, and of these the value of manufactures did not reach $400,000. In 1859 the exports amounted to $24,766,981, among which were manufactures to the value of $487,231, showing a large relative increase. The importations of 1857 amounted to twenty-nine million dollars in round numbers, and among the items are numerous articles which every one may wonder are not manufactured to a larger extent in this province. Woolens to the value of $3,900,000 were imported in 1857. Leather manufactures to the extent of $514,493; Refined sugar, $171,270; Ale and Beer, $100,000; Carpets, $132,000; Candles, $72,000; Cotton manufactures to the extent of nearly five million dollars, and a vast number of other articles for which there is a rapidly growing market. The field for manufacturing enterprise is ample, but means, namely CAPITAL and SKILL, are either too limited or at present inaccessible.

The census tables for 1851 convey a fair idea of the then condition of manufacturing industry in the Province as far as it goes, and from it, it may be inferred that all the elements of this important interest exist in abundance, with the exception of those mentioned in the preceding paragraph. The census about to be taken will supply the basis of future action, and show in what direction the influence of the Boards of Arts and Manufactures may be most advantageously exerted. Information on all topics bearing upon the objects for which they were incorporated is much needed, and until this hiatus be supplied it is impossible that they can adequately fulfil the duties belonging to them.

Since 1851 great strides have undoubtedly been made in various kinds of industry, particularly in Upper Canada, and numerous establishments on an extensive scale are now in active and successful operation; but in order to form an adequate conception of what may be accomplished, it is desirable to know with accuracy and detail what has been already done.

The immense importance of the lumber trade is patent to all. An industry which absorbs twenty five thousand able bodied men is necessarily an interest of the greatest magnitude, although only a part of it can be included under the heading of Arts and Manufactures. Not so, however, with Pot and Pearl Ashes. The production of the raw material is a rude process, capable of considerable improvement, but the production of numerous articles of great commercial value from the crude materials might be very advantageously pursued in Canada, where the raw material is cheap and abundant. The value of exported pot and pearl ashes amounted in 1857 to $1,145,452, one fourth of this product being shipped to the United States, the other three fourths to the United Kingdom. Leather including manufactured articles, and the preparation of the raw material is one of the most important branches of industry in the Province, and its annual value exceeds $10,000,000. The Hardware industry may be symbolized by $1,200,000 per annum, it is steadily increasing and promises to become a valuable source of national wealth. Manufactures in Wood, Wool, Cotton, and Paper may reach $1,800,000 and are yet in their infancy; Whiskey, Soap, and Candles, and other minor branches of industry, represent a combined annual product of not less than $1,200,000. In the aggregate the annual value of the Manufactures of Canada exceed $15,000,000, or three-fourths of the total amount imported in 1857. On another page an abstract is given in tabular form of the statistics of manufactures in Canada as far as ascertained. With a rapidly increasing population, an extensive country, in which exist most of the materials forming the basis of modern industry, the field for action, co-operation, mutual encouragement and assistance is large and promising, and as far as this journal is concerned, it is occupied with confidence and a firm belief in a successful issue.



SPENCER'S ADDRESSING PRESS,

Patented in Canada, Great Britain. and the United States

The above cut represents the largest size of these machines. *A* is the frame, upon the top of which are the grooved rails *r r*, on which the carriage *B* runs in a longitudinal direction. The bed rests on the top of the carriage, and is provided with a grooved track, so as to be moved laterally, in order to bring the several columns in the form successively under the aperture *S* in the tympan or shield. The carriage is moved by the pawl *f*, which works with the toothed rack on the side of the carriage.

The names of subscribers to periodicals are set up in narrow columns and separated by quads, so as to allow only one to be printed at each impression, and the columns, when the form consists of more than one, are also separated by riglets. The form thus made up and inked, is placed upon the bed of the machine; the first name in the column at the left hand is brought under the aperture in the tympan, and the machine is set in motion by the power applied to the fly-wheel by means of the foot-treadle *1 R L*, which, operating upon the pawl *f* by means of a cam and lever, causes the carriage to move at each revolution of the shaft the distance required to bring each name under the aperture in the shield; and the matter to be printed is placed over the aperture, and is pressed upon the type by the small platen or stamp through the aperture—all other parts of the form being protected from contact with the paper—and thus the desired impression is made. As soon as the platen rises, the paper is thrown off by the fly upon a moving apron.

When the carriage has run the whole length of the first column, its motion is reversed, and at the same time the bed moves from right to left, so as to bring the next column in the line of the aperture in the tympan, and so traversing each column alternately down and up, until all the names in the form have been printed; which is to be removed, and another placed upon the bed, and the operation repeated. An expert hand can print addresses with one of these machines at the rate of from three to four thousand per hour, without any liability to errors or omissions.

A simpler kind of these machines is made, on the same principle, in which the carriage runs only one way, and is drawn back by hand, and the bed moved laterally by the same means. These vary in price according to size and quality, from fifty to one hundred and fifty dollars, which are capable of printing addresses at the rate of from one to two thousand per hour.

As the type used in these machines are arranged in ordinary forms, all difficulty is obviated in changing addresses of subscribers, and inserting names or dropping them; and types that are too much worn for ordinary printing may be used for this purpose.

Several of these machines are in operation both in Canada and the United States and Nova Scotia, and the labor-saving value of the invention is now fully tested. The cost of addressing periodicals by this machine is only about one-fourth that of writing them. The address can be printed either on the wrapper or on the margin of the paper.

COTTON MANUFACTURES IN CANADA.

No branch of manufacturing industry is so much needed in Canada as that of Cotton. In a future number an enumeration of what is now doing will be given. Subjoined is a table showing the imports of Cotton manufactured and unmanufactured, into this Province, from 1853 to 1858.

Table showing the value of Importation of Cotton Manufactures into Canada, during the years 1853 *to* 1859, *inclusive.*

YEAR.	VALUE.	DUTY.
1853	$5,262,743	$657,843.
1854	5,076,349	634,543.
1855	3,307,894	425,496.
1856	5,028,935	678,894.
1857	4,796,046	719,413.
1858	3,315,119	497,234.
1859	4,863,444	902,150.

able showing the value of Cotton Wool imported into Canada, during the years, 1853 *to* 1859 *inclusive.*

YEAR.	VALUE.
1853	$17,907
1854	15,256
1855	14,831
1856	19,040
1857	3,557
1858	11,238
1859	17,882

able showing the value of Cotton Yarn and Warp imported into Canada during the years 1853 *to* 1859, *inclusive.*

YEAR.	VALUE.
1853	$140,034
1854	112,323
1855	119,056
1856	116,516
1857	151,308
1858	149,595
1859	204,672

COMMERCE OF CANADA IN 1859.

lue of Imports in 1859	$33,555,161 00
lue of Exports in 1859	24,766,981 00
ount of duty collected	4,437,846 12

Trade with the United States.

ue of Imports	$17,592,916
ue of Exports	13,922,314

parative Statement of Value of Imports and Exports of Canada for years 1858 *and* 1859.

orts, 1858	$29,078,527
" 1859	33,555,161
orts, 1858	23,472,609
" 1859	24,766,981
l Imports and Exports, 1858	52,551,136
" " " 1859	58,322,141

ease in 1859, $5,771,006, or 11 per cent.

Comparative Statement, showing the Gross Values of Articles of Canadian Produce and Manufacture, exported during 1857, 1858 *and* 1859.

ARTICLES.	1857.	1858.	1859.
Produce of the Mines	286,469	314,823	468,512
" " Fisheries	540,113	718,296	817,423
" " Forest	11,575,508	9,284,514	9,663,962
Animals and their Products	2,262,119	2,625,978	3,789,502
Agricultural Products	8,882,825	7,904,400	7,339,798
Manufactures	398,821	325,376	487,231
Coin and Bullion	....	....	3,652
Other Articles	121,120	112,538	110,732
Value of Ships built at Quebec	1,383,444	743,640	421,566
Estimated Exports short returned	1,556,205	1,443,044	1,664,603
Total value of Exports......$	27,006,624	23,472,609	24,766,981

Statistical View of the Commerce of Canada, exhibiting the Value of Exports to and Imports from Great Britain, her Colonies, and Foreign Countries, during the year 1859.

COUNTRIES.	VALUE OF EXPORTS.	VALUE OF IMPORTS.
Great Britain	7,976,758	14,786,084
North American Colonies	840,475	381,755
British West Indies	7,025	533
United States of America	13,922,314	17,592,916
Other Foreign Countries	355,806	793,873
Total ....$	23,102,378	33,555,161

Comparative Statement of the Quantity and Value of the principal articles of Canadian Manufactures, exported during the years 1857, 1858 *and* 1859.

	1857.		1858.		1859.	
	QUAN.	VALUE.	QUAN.	VALUE.	QUAN.	VALUE.
Books	....	....	....	4,505	....	3,866
Cotton	....	$2,162	....	276	....	325
Candles..........Lbs.	6,676	1,138	8,427	1,246	8,218	1,040
Furs	....	6,258	....	1,130	....	9,440
Glass	....	122	....	286	....	924
Hardware	....	18,290	....	13,218	....	14,621
India Rubber	....	163,698	....	80,067	....	261,815
Indian Barkwork	....	409	....	351	....	581
Leather	....	4,044	....	4,664	....	8,584
Linen	....	....	....	436	....	87
Machinery	....	9,075	....	12,053	....	13,063
Musical Instruments	....	736	....	1,350	....	996
Carriages ......Number	105	7,035	219	10,693	835	12,946
Starch ....Lbs.	....	76	1,484	148	69	7
Straw	....	8,039	....	14,358	....	9,433
Rags	....	15,641	....	12,401	....	22,701
Soap ....Lbs.	....	2.281	16,824	1,321	86,752	6,092
Sugar Boxes...Number	....	40,358	111,671	45,298	56,900	18,502
Oil Cake	....	16,169	....	15,593	....	22,945
Biscuit ....Cwt.	....	11,714	1,126	5,600	1,780	9,325
Wood	....	33,049	....	50,126	....	41,470
Woolens	....	1,377	....	1,861	....	864
Ground Plaster & Lime	....	9,578	....	6,655	....	4.235
Liquors—						
Ale, Beer & Cider.Galls.	14,890	3,729	35,351	7,422	25,947	6,290
Whiskey .... do.	2,424	1,937	1,879	977	12,972	7,465
Other Spirits ... do.	14,625	41,626	18,297	33,056	8,754	9,113
Vinegar.......... do.	613	280	1,302	285	2,247	501
Total Manufactures...	....	398,821	....	325376	....	487,231

Manufacture of Malt Liquor in Canada.

The number of gallons brewed in the province in 1858, was 1,247,803; of this quantity Canada East produced, 397,428 gallons, and Canada West, 850,375 gallons. The duty amounted to $14,107. The number of gallons brewed in 1859, reached 3,566.854, being 1,365,597 for Canada East, and 2,201,257 gallons for Canada West. The total duty including licenses, amounted to $37,318 54.

Manufacture of Proof Spirit in Canada.

In 1858, the number of stills for the manufacture of proof spirit was 120, being ten in Canada East, and 110 in Canada West. The amount of spirit produced was, 864,696 gallons in the eastern part of the Province, and 2,543,701 gallons in the western. The total amount was 3,408,397 gallons, or about one gallon and a half for every man, woman, and child in the province. The duty collected on spirits amounted to $126,942. In 1859 the number of stills was 109, and of gallons of proof spirit manufactured, 3,308,098; the duty amounted to $198, 485.87.

The Acton Mines.

The quantity of copper ore exported from Acton, in Lower Canada, during the present year by the Grand Trunk Railroad, was 1,825 tons, between the months of February and November, and the declared value of this export amounted to $120,502.

EDUCATIONAL SUMMARY FOR THE YEAR 1859.*

The total number of educational institutions of every description in Upper Canada reported, was 4,372—increase, 114; the total amount expended in support of these institutions, was $1,389,582; adding balance on hand, the total amount available was $1,594, 807—being an increase of $83,791. But the total number of pupils returned as attending the Common and Grammar Schools, was 305,973—increase 7,831; and a small decrease of 152 students and pupils attending other institutious, exclusive of the Normal and Model Schools. The aggregate amount available for the support of the Common, Grammar, and Normal Schools, Superannuated Teachers, &c,, (not including other educational institutions), during the year, was $1,430,304—being an increase of $86,013; thus showing a decrease of $2,222, in the amount expended in the support of other institutions.

General Statistical Abstract of the Progress of Education in Upper Canada, from 1850 *to* 1859 *inclusive.*

1. Grammar Schools.—The number of *Grammar-Schools* in 1850, was 57; in 1859 it was 81. The number of pupils attending the Grammar Schools in 1850, was 2,070; in 1859, it was 4,381, though many hundreds were excluded from the Grammar Schools in 1854 by the Regulations which required an entrance examination—increased attendance in 1859 over 1850, 2,311. As the present Grammar School Law did not go into operation until 1854, no returns of the amount provided for the salaries of Grammar School Masters exists earlier than 1855. The amount provided for the salaries of Masters in 1855, was $46,255; the amount provided for the same purpose in 1859, was $61,564.

2. Common Schools.—The number of Common Schools in 1850, was 3,059; the number in 1859, was 3,953—total increase, 894. The number of *Free* Schools in 1850, was 252; the number in 1859, was 2,315—total increase in the ten years, 2,063.

3. The whole number of pupils attending the Common Schools in 1850, was 151,891; the number of pupils attending them in 1859, was 301,592—increase of 1859 over 1850, 149,701.

4. The total amount paid for salaries of Common School Teachers in 1850, was $353,716; the amount paid for the same purpose in 1859, was $859,325—increase of 1859 over 1850, $505,609.

5. The amount expended for the building and furnish[ing] of school-houses, libraries, apparatus, &c., in 185[0] was $56,756; the amount expended for these purpos[es] in 1859, was $250,721—increase of 1859 over 185[0] $193,965.

6. The total amount expended for all common Scho[ol] purposes in 1850, was $410,472; the total amount e[x]pended for these purposes in 1859, was $1,110,046—t[he] increase of 1859 over 1850, $699,574.

Two remarks may be made in reference to t[he] foregoing statistics and others contained in the tab[les] referred to. The first remark is, that little more th[an] one-tenth of the sums of money mentioned have be[en] provided by the Legislature from endowments and gran[ts]. The Legislature imposes no tax for any educational pu[r]pose. All the rest of the large sums mentioned a[re] provided by voluntary local taxation and other exertio[ns] in each municipality.

The second remark is, that the above statements re[fer] entirely to amounts of money provided and expended [for] School purposes, and the number of pupils attending t[he] Schools, not taking into account at all the improveme[nts] which have been affected in the school-houses and th[eir] furniture, in the character and qualifications of Sch[ool] Teachers, in the text-books, apparatus, discipline, [and] teaching of the schools, the establishment of school [li]braries and other agencies and facilities for the diffus[ion] of useful knowledge.

* Annual Report of the Normal, Model, Grammar and Common Schools in Upper Canada for the year 1859, by the Chief Superintendent of Schools.

The Board of Arts & Manufactu[res]

FOR UPPER CANADA.

PROCEEDINGS OF THE BOAR[D]

PRIZE ESSAY.

The Board of Arts and Manufactures for U[pper] Canada, in order to attract and direct the employ[ment] of European and other capital towards Upper C[ana]dian Manufactures, hereby offers a first prize of [...] Hundred and Fifty Dollars, and a second pri[ze of] Seventy-five Dollars, for the first and second [best] Essays on "The Manufactures which are [best] suited to the circumstances and capabiliti[es of] Upper Canada," taking into account:

1st. The raw materials produced in the Prov[ince], as well as those most easily obtained from [other] countries.

2nd. The natural facilities, as well as the me[chan]ical capabilities of the Province.

3rd. The populations of the cities and cou[ntry], male and female, not required in the ordinar[y do]mestic employments.

4th. Articles that can be advantageously [manu]factured in Upper Canada, with the difference [in] prices here, and at the places from which th[ey are] usually imported; showing the margin of pr[ofit to] cover the additional cost of labour.

5th. The articles of Upper Canada manuf[actu]re for which there is, at the present time, a g[reater] demand than can be supplied.

Each Essay must be sent under cover [to the] Secretary of the Board, on or before the 1st [day]

July, 1861; and be accompanied by an enclosure containing the author's name and address, and having a mark or seal on the outside corresponding with a mark or seal on the Essay.

The Judges will be appointed by the Executive Committee of the Board, and their award, as soon as made, will be published in the Journal of the Board.

No prizes will be awarded unless the Essays are considered worthy by the Judges.

W. Edwards,
Secretary.

MODEL ROOMS AND LIBRARY.

The Model Rooms, and the free Library of Reference, illustrative of the Industrial and Decorative Arts and Manufactures, now in course of formation, are open to the Public, daily, at the Board Rooms, 79 King Street West, Toronto, from 10 A.M. till noon, and from 1 to 4 o'clock, P.M.

In the Model Rooms are deposited about 500 Models of Canadian Patented Inventions.

The Library contains upwards of 400 folio and octavo volumes of Specifications, Plates, Indices, &c., &c., of British Patented Inventions; 95 volumes of Cyclopœdias, Dictionaries, and Works on Arts, Manufactures and Decoration; 100 volumes of Statutes, Journals, &c., of the Legislature of Canada; and a large number of Pamphlets containing Parliamentary and other Reports. There are also 17 of the leading British and American Mechanical and Scientific Journals regularly received at the Rooms.

A large number of valuable English works have recently been ordered by the Executive Committee.

The publication of a catalogue of the above-mentioned works, and of such others as it is intended to add to the Library from time to time, will be commenced in the next number of the Journal.

NOTICE OF MEETING OF THE BOARD OF ARTS, &c.

In accordance with the requirements of the Act constituting this Board, the Annual Meeting will be held on Wednesday, the 2nd January, instant, at 1 o'clock, p.m., at the Board Rooms, 79 King Street West, Toronto. Owing to the time named following so close on New Year's day, a quorum may not be obtained; and in the event of this being the case, an adjournment will have to be made to some future day, of which due notice will be given.

For the information of the members of the Board, and the officers and members of Mechanics' Institutes and Boards of Trade, sections 22, 23, 25 & 27, chap. xxxii. of the Consolidated Statutes of Canada: and also By-law No. X. of this Board, are appended:—

Sec. 22.—The said Corporations shall respectively be composed of—the Minister of Agriculture for the time being (who shall be *ex officio* a member of each)—the Professors of and Lecturers on the various branches of physical science in all the Chartered Universities and Colleges in Upper and Lower Canada respectively—the Chief Superintendents of Education in Upper and in Lower Canada respectively for the time being, *ex officio* —the Presidents for the time being of and one Delegate from each of the Boards of Trade—and the Presidents of and Delegates from each of the incorporated Mechanics' Institutes, or of any incorporated Arts Associations qualified as hereinafter mentioned, in Upper and Lower Canada respectively—such Delegates to be chosen annually as hereinafter is provided.

Sec. 23.—The Board of Trade in each City and Town in Upper Canada, shall, at its first meeting in the month of January, in each and every year, elect and accredit to the Board of Arts and Manufactures for Upper Canada, one of its body as a member thereof.

Sec. 25.—Each incorporated Mechanics' Institute in Upper and Lower Canada respectively, shall, at its first meeting, in the month of January, in every year, elect and accredit to the Board of Arts and Manufactures in Upper or Lower Canada respectively, (according as its place of meeting is in Upper or Lower Canada,) one delegate for every twenty members on its roll, being actual working mechanics or manufacturers, and having paid a subscription of at least one dollar each, to its funds for the year then last past.

Sec. 27.—The names of the Delegates so elected shall be forthwith transmitted by the Secretary of the Board or Institute electing them, to the Secretary of the Board to which they are elected, who shall thereupon inscribe their names upon the Roll of the Members of the said Board, for the year then about to commence; with the names of the Delegates when transmitted by the Secretary of a Mechanics' Institute, there shall be transmitted a statement verified by the oath of the Secretary transmitting the same, to be taken before a Justice of the Peace, of the names of all the members on the roll of such Mechanics' Institute, being actual working mechanics or manufacturers, and having paid subscriptions of at least one dollar each to its funds, for the year then last past.

By-Law X.—The Delegates from each Mechanics' Institute shall, before taking their seats as members of the Board, present to the Secretary a certificate, under the Corporate Seal of the Institute from which they come, signed by the President or Vice-President, and countersigned by the Secretary thereof, stating their appointments as such Delegates; and the Delegates from each Board of Trade, before taking their seats, shall present a certificate of their election, signed by the President, and countersigned by the Secretary of such Board.

The Delegates for the past year, from such Mechanics' Institutes and Boards of Trade as shall not have had a new election prior to the Annual Meeting of the Board, will be entitled to take their seats at such meeting.

W. Edwards,
Secretary.

EXAMINATION OF CANDIDATES FOR CERTIFICATES.

The following programme of a scheme for holding Periodical Examinations has been sent to the Presidents of the several Mechanics' Institutes in Upper Canada:—

Sir,—This Board has determined upon holding periodical examinations of such members of the various Mechanics' Institutes in Upper Canada as may choose to avail themselves of them, under the rules and restrictions hereafter laid down; the object of such examinations being to encourage, test, attest and reward efforts made by the industrial classes for self-improvement.

These examinations will be open to all members of incorporated Mechanics' Institutes or Library Associations in Upper Canada, who are over 16 years of age, and are not students of any college, graduates or under-graduates of any University, or certified school teachers; or who are not following any of the learned professions.

The Board earnestly invites the co-operation of the managers of the respective Institutions, in carrying out the following scheme of

$$\left.\begin{array}{c}\text{Previous}\\ \text{and}\\ \text{Final.}\end{array}\right\}\text{Examinations by}\left\{\begin{array}{c}\text{Local Committees.}\\ \text{The Board of Arts and}\\ \text{Manufactures.}\end{array}\right.$$

Local Committees.

1.—The Managers of Mechanics' Institutes and Library Associations desirous of co-operating with this Board, in promoting the education of such of their members as have not been able to avail themselves of the benefits of academical instruction and distinction, but who are now willing to engage in classes or evening schools, or other means of self-improvement, are invited to form local committees for the purpose of organising and superintending classes; for the holding of the necessary preliminary examinations; and to assist and co-operate with the examiners appointed by the Board. Each local committee must consist of at least three members, and should be composed of such persons as would command the respect and confidence of the community.

2.—Each local committee should submit to the Secretary of this Board, on or before the first of January, 1861, a list of the names of the Chairman and Secretary, and other members of the local committee.

Previous Examinations by the Local Committees.

3.—The local committees will conduct the previous examinations of their own candidates, and also supervise the working of papers which the examiners appointed by the Board will set for the final examinations.

4.—No candidate will be admitted to the final examination without a certificate (see Form No. 4 in Appendix) from his local committee, that he has satisfactorily passed its previous examination; especially in the subjects in which he wishes to be examined by the Board.

5.—The previous examinations by the local committees may be either wholly written, or partly oral and partly written, as each local committee may think best; and must be held sufficiently early in the year to allow the results to be communicated to the Secretary of this Board, on or before the first day of May, 1861.

6.—The local committee may, with advantage, admit to the previous examinations, and grant suitable certificates and rewards to persons of very humble attainments; but the "pass" to the final examinations should not be given to any candidates, however meritorious, whom the local committees consider to have no chance of obtaining certificates from the Board.

Final Examination by the Examiners appointed by the Board.

7.—Forms containing the names of the candidates passed by the local committees, and the subjects in which they wish to be examined, must be returned to the Secretary of the Board not later than the first day of May, 1861, (see Form No. 4 in the Appendix.)

8.—The Examiners appointed by the Board will then set the requisite papers for the final examination, and these will be forwarded to the local committees. The local committees will see, and certify to the Board, in the form which the Board will furnish, (see Appendix, Form No.7), that the papers are fairly worked by each candidate, without copying from any other, and without books or other assistance; and will return the worked papers to the Board.

9.—The final examinations will be conducted by printed papers.

10.—The examiners will award certificates of three grades, but certificates of the first grade will be awarded only to a high degree of excellence.

11.—The final examinations will be held simultaneously on the days, and at the hours specified in the time-table for 1861, (Appendix, Form No. 6) at those institutions where local committees are established.

12.—Judgment will then be passed by the examiners appointed by the Board, and the awards of certificates will be communicated to the respective local committees.

13.—The following are the subjects appointed for the final examinations in May, 1861:—

I. Arithmetic.
II. Book-keeping.
III. Algebra.
IV. Geometry.
V. Mensuration.
VI. Trigonometry.
VII. Conic Sections.
VIII. Principles of Mechanics.
IX. Practical Mechanics.
X. Magnetism, Electricity and Heat.
XI. Astronomy.
XII. Chemistry.
XIII. Animal Physiology.
XIV. Botany.
XV. Geology and Mineralogy.
XVI. Agriculture and Horticulture.
XVII. Geography.
XVIII. Political and Social Economy.

XIX. History.
XX. English Grammar and Composition.
XXI. English Literature.
XXII. French.
XXIII. German.
XXIV. Music.
XXV. Drawing and Modelling.
XXVI. Penmanship.

14.—To indicate the portions of the subjects that will be taken in the examinations, certain text-books have been set down for the several departments; but it is distinctly to be understood, that in so doing no opinion is pronounced as to the comparative merits of the works named. The books selected are, generally, those in common use. Real knowledge, however or wherever acquired, will be accepted, and the exposition of a subject in the candidate's own words will be preferred by the examiners.

I. Arithmetic.

15.—Fundamental rules of Arithmetic; Proportion, Simple and Compound; Practice; Interest, Simple and Compound; Fractions, Vulgar and Decimal; Extraction of Square and Cube Roots.

16.—The Examiners will take into account not only the correctness of the answers, but the excellence of the method by which they are worked out, and the clearness and neatness of the working (which must always be shown).

17.—Text Books; any of the modern treatises on Arithmetic.

II. Book-Keeping.

18.—Book-keeping by Single and Double Entry; Drafts of the various forms of Bills of Exchange, Promissory Notes, Invoices, &c.; and an accurate knowledge of the various books used in the counting house.

19.—Text Books:—Principles of Book-keeping, by W. Scott Burn (*Rowsell*, Toronto); Kelly's Elements of Book-keeping (*Simpkins & Co.*).

III. Algebra.

20.—Algebraical Fractions, Square and Cube Root, Greatest Common Measure, Least Common Multiple, Simple and Quadratic Equations single and simultaneous, Ratio and Variation. Candidates should be prepared to give explanations of Elementary Principles and proofs of Fundamental Propositions.

21.—Text Books:—Colenso's Algebra (*Longmans'*) or Barnard Smith's Algebra (*Bell and Daldy*).

IV. Geometry.

22.—A facility in solving geometrical theorems and problems, deducible from the first six books of Euclid, will be expected on the part of those who desire to obtain certificates of the first or second class.

23.—Text Books:—Euclid, Books I., II., III., IV., VI., XI., and XII. Potts' smaller edition (*Parker*), or Colenso's Edition of Simpson's.

V. Mensuration.

24.—The calculation in numbers of the areas and circumferences of plane figures bounded by arcs of circles or right lines. The superficial and solid contents of cones, cylinders, spheres, &c.

25.—Measuring and estimating artificer's work.

26.—Text Books:—Tate's Mensuration. Young's Treatise on Mensuration (*Simms and M'Intyre*).

VI. Trigonometry.

27.—In Plane Trigonometry, the formulæ for the trigonometrical functions of the sum of two angles, the numerical solution of plane triangles, and the use of logarithmic tables, &c.

28.—Spherical Trigonometry, Napier's Rules, Solution of Spherical Triangles.

29.—Text Books:—Colenso's Trigonometry (*Longman*). Snowball's Trigonometry (*Macmillan*, Cambridge). Hall's Trigonometry for Schools (*Christian Knowledge Society*), or any of the modern treatises on Algebraical Trigonometry. Mathematical Tables (*Chambers' Series*).

VII. Conic Sections.

30.—The properties of the three curves treated geometrically; also as deduced from the cone. The principles of projection, orthogonal and central, applied to derive the properties of the Conic Sections from those of the circle.

31.—Analytical Conics, including the equations of the straight line, the circle, the three conic sections, and the general equation of the second degree.

32.—Text Books:—Puckle's Conic Sections (*Macmillan*). Todhunter's Conic Sections (*Macmillan*). Salmon's Conic Sections (*Longmans'*). Drew's Conic Sections (*Macmillan*). Whewell's Conic Sections (*Parker*).

VIII. Principles of Mechanics.

33.—The properties of matter, solid, fluid, and gaseous.

Statics: The composition, resolution, and equilibrium of pressures acting on a material particle; constrained particles; machines; attractions.

Dynamics: Gravitation; collision; constrained motions; projectiles; oscillations.

Rigid Dynamics: Motion of a rigid body about a point;—of a free rigid body;—of a system of rigid bodies.

Hydrostatics: Pressures of fluids; equilibrium of floating bodies; specific gravity; elastic fluids; machines; temperature and heat; steam; evaporation.

Hydrodynamics: Motion and resistance of fluids in tubes, &c.; waves and tides.

Pneumatics: Mechanical properties of the air; the barometer.

34. Text Books:

Wood's or Todhunter's Mechanics.
Goodwin's Mathematics.
Miller's, Phear's, or Webster's Hydrostatics.
Webster's Theory of Fluids.
Orr's Circle of the Sciences.
Cherriman's Statics and Dynamics (*Maclear & Co.*).
Olmsted's Natural Philosophy (College Edition.)
Golding Bird's Elements of Natural Philosophy by C. Brooke (*Churchill*).
Lardner's Handbooks on Natural Philosophy.

IX. Practical Mechanics.

35.—The Application of the Principles of Mechanism to Simple Machines. The Steam Engine.

36.—Text Books:—Lardner on the Steam Engine. Nasmyth's Elements of Mechanism, with Remarks on Tools and Machinery (*Weale*).

X. Magnetism, Electricity, and Heat.

37.—The Properties of Magnets; Terrestrial Magnetism; Diamagnetism. Statical or Franklinic Electricity; Voltaic Electricity; Electrodynamics; Thermo-Electricity; the Electric Telegraph.

Conduction, Convection, and Radiation of Heat; Instruments for Measuring Heat; Specific and Latent Heat; Diathermancy.

38.—Text Books:—Lardner's Handbooks of Natural Philosophy (*Walton and Maberly*).

Golding Bird's Elements of Natural Philosophy, by C. Brooke (*Churchill*).

XI. Astronomy.

39.—The Principles of Plane Astronomy.

40.—Text Books:—Herschel's Astronomy. (*Longmans'*). First chapters.

Airy's Lectures on Astronomy.

XII.—Chemistry.

41. Physical. Elementary laws of heat, light and electricity, in connection with chemical action.

Inorganic. Chemistry of the metalloids and metals, laws of combining proportions, volumes of gases, vapours, &c.

Organic. Composition, properties and decompositions of alcohols, acids, &c.

42. Candidates are expected to be able to explain decompositions by the use of symbols. Questions illustrative of general principles will be selected from the following amongst other trades and manufactures: Metallurgy of Lead, Iron and Copper; Bleaching, Dyeing, Soap-boiling, Tanning; the manufacture of Coal-Gas, Sulphuric Acid, &c.

43. Text Books:—Fownes' Manual of Elementary Chemistry. Miller's Elements of Chemistry. Croft's Chemistry (*Maclear & Co.*); Elements of Chemistry (*Chambers' Educational Course*).

XIII.—Animal Physiology.

44. The general principles of Animal Physiology. Practical application of them to health and the wants of daily life.

45. Text Books:—Carpenter's Animal Physiology 1859 (*Bohn*).

Lardner's Animal Physics (*Walton and Maberly*).

Translation of Milne-Edward's Manual of Zoology (*Renshaw*).

XIV.—Botany.

46. Vegetable Physiology. Classification of Plants. Leading principles of Morphology. Scientific and applied Botany.

47. Text Books:—Gray's Botanical Text Book; Lindley's School Botany; Henfrey's Rudiments of Botany, and Henfrey's Rudimentary Course of Botany.

XV.—Geology and Mineralogy.

48. The properties and distinctive characters of the commonly occurring Minerals and Metallic Ores; the structural characters, conditions of occurrence, and classification of Rocks generally.

49. Geological Phenomena now in action, with Theory of Springs, Currents, Tides, Winds, &c.

50. Text Books:—Dana's Manual of Mineralogy; Lyell's Elementary Geology; and Buff's Physics of the Earth.

XVI.—Agriculture and Horticulture.

51. Theory and Practice of Agriculture and Horticulture. Results of Tillage operations; Effects of particular Manures, Draining, &c.; Management of Stock, and general Economy of the Farm.

52. Knowledge and Management of the Orchard and Garden. Pruning, Grafting, &c.

53. Text Books:—Johnston's Elements of Agricultural Chemistry and Geology; Johnston's Lectures on do.; Youatt's Treatises on the Horse, Cattle, Sheep and the Pig; Low's Principles of Practical Agriculture.

XVII.—Political and Social Economy.

54. Text Books:—Elements of Political Economy, by James Mill. Principles of Political Economy, by John Stuart Mill.

The Phenomena of Industrial Life. Edited by the Dean of Hereford (*Groombridge*).

Whately's Lectures on Political Economy (*Parker*).

55. Some knowledge of the Commercial, Financial and Statistical History of the United Kingdom and of Canada, will be required.

N.B.—The Principles of Political Economy, by John Stuart Mill, need be studied only by those who aspire to a first-class Certificate.

XVIII.—Geography.

56. Political Geography. General Questions in Ancient and Modern Geography; Maps drawn from memory; Explanation of Geographical Definitions.

57. Mathematical Geography.

58. Physical Geography. Outlines of Physical Geography.

59. Text Books:—Stewart's Modern Geography; Anderson's Modern Geography; Pillan's Ancient Geography; Mrs. Somerville's Physical Geography; Chambers' Atlas. For reference, Blackie and Son's Imperial Gazeteer.

XIX.—History.

60. Outlines of Greek and Roman History; English History from the Norman Conquest; Canadian History.

61. Text Books:—Schmitz's Manual of Ancient History; White's Great Britain and Ireland; Hamilton's Outlines of English History; Hallam's Middle Ages, ch. viii. (*Murray*); Student's Hume; Roy's History of Canada; Boyd's History of Canada (*J. Campbell*).

XX.—English Literature.

62. Shakspeare's "Hamlet."
Milton's "Paradise Lost," Books I. and II.
Spenser's "Faerie Queen," Book I.
Cowper's "Task."
Pope's "Essay on Man."
Wordsworth's "Excursion," Books I. and II.
Bacon's "Essays."
Bacon's "Advancement of Learning," Book I.
Addison's "Spectator."
Johnson's "Rambler."
Craik's "History of the English Language."
Trench on the "Study of Words."

N.B. Candidates may select any two of the authors in the above list.

63. Candidates are recommended to make a very careful study of the text of the authors they may select The questions on each author will be divided into two sections, the first intended to test the candidate's acquaintance with the text, the second his knowledge of the subject matter, and his critical and literary information. Full marks will not be given for answers to the second section, if those to the first section do not prove satisfactory.

XXI.—English Grammar and Composition.

64. Grammatical Analysis of Sentences in Prose and Poetry; Composition on a given subject.

65. Text Books:—Dr. Connon's System of English Grammar; Parker's English Composition; Dr. Reid's English Composition.

XXII.—French.

66. The Examination paper will be divided into three parts.

The first will comprise questions on any portion of the French Grammar (To be answered in French, if possible), and an extract from a contemporary French writer to be translated into English. Candidates, in order to obtain a 3rd class certificate, should do full justice to this first part.

The second part will comprise an English extract to be translated into French, and a list of idiomatic expressions to be rendered from French into English or *vice versa.* This should be done satisfactorily by the candidate who aims at a 2nd class certificate.

In the third part, candidates for the 1st class certificate will have, in addition to the above, to answer properly some *elementary* questions on the three following subjects:

1. French literature from 1830 to 1848.
2. French Weights and Measures as compared with the English.
3. The Religious Wars in France in the 16th century.

67. Text Book:—Michelet's *Réforme* (volume viii. of his *Histoire de France.*)

XXIII.—German.

68. Schiller's "Wilhelm Tell." Grammatical and Critical Analysis of.

Goethe's "Iphigenie Auf Tauris."

Goethe's "Egmont."

Composition on a given subject.

Pieces from each of the above works will be given for translation. Every candidate must translate one piece. First-class certificates will be given to those only who translate well from English, and write in German a good Essay relating to German History since the Reformation.

XXIV.—Music.

69. Theory of Music. Notation, the modern modes, intervals, time signatures, the stave, transposition, modulation, terms and characters in common use.

70. Elements of Harmony.

71. Arrangements must be made in the previous examinations by the local committees, to test candidates by oral examination, in their knowledge or appreciation of the sound of musical successions and combinations. A form of the test to be used for this purpose by the local committees, at the previous examinations, will be sent by this Board to such local committees as may apply for it, in due time before the examination.

XXV.—Drawing and Modelling.

72. Orthographical Projection, or Geometrical Drawing, of Architectural or Engineering subjects, Machinery, &c.

Linear Perspective.

Ornamental Drawing of Natural or Conventional objects.

Original Designs.

Landscape Drawing in pencil, crayon, water colours, or in oil.

73. Models of figures, groups, foliage, &c., connected with the Fine or Decorative Arts.

74. The local committees will select, and forward to the Board, such specimens of Drawing and Modelling as they may deem worthy, and which they shall certify to be the work, solely, of the candidate named, who may not be an artist by profession.

XXVI.—Penmanship.

75. Business Hand. An even round hand, without flourishes, will be preferred.

76. Ornamental Penmanship.

77. Specimens to be selected by the local committees, and forwarded to the Board, on the same conditions as specimens in department XXV.

TERMS OF ADMISSION TO THE EXAMINATIONS.

78. Every candidate for examination must be passed by a local committee, and must be a member of, or student of a class in, an Incorporated Mechanics' Institute or Library Association in Upper Canada.

APPENDIX.

The following forms, that will be forwarded at the proper time to the local committees, are here published, in order that the committees may know before hand what arrangements they will have to carry out in co-operation with this Board.

Form No. 1.

Board of Arts and Manufactures, Toronto.

Sir,—I forward to you a return, (No. 2,) which I shall be obliged by your filling up and re-posting to me, as soon as possible, in order that the necessary Forms (No. 4) may be forwarded to you.

I am, Sir, your obedient servant,

————, Secretary.

To the Secretary, Local Com. of————

Form No. 2.—Return of Candidates who have attended the previous Examinations.

———— Local Committee,

————, 1861.

Sir,—I beg to inform you that, on the*———— of ———— Candidates underwent the previous Examination; that † ———— of these Candidates passed the Examination satisfactorily; and that † ———— of them desire to present

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* Insert date. † Insert number.

themselves at the Final Examinations. I have, therefore, to beg that you will furnish me with the requisite number of the Forms (No. 4).

(Signed)——————
Secretary, Local Com.

To ——————, Secretary
of the Board of Arts and Manufactures.

FORM No. 3.—Circular taking out supply of Forms No. 4 to Local Committees.

Board of Arts and Manufactures, Toronto.

SIR,—I am directed by the Board of Arts and Manufactures to forward the accompanying ——— Forms (No. 4) for the Candidates who are reported by your Local Committee qualified for the Final Examination.

I am to request that these forms may be filled up, signed, and returned to me as soon as possible, not later than the 1st of May, as the number of papers to be prepared, and other important details of the Final Examination, cannot be settled until the returns from all the Local Committees are complete.

One of the forms now sent to you is to be filled up, partly, as you will perceive, by, and partly on behalf of, each candidate. Every such candidate must carefully remember the number entered, in red ink, at the head of the form which is given to him, as this number (and not his name) will have to be entered on each of his papers at the Final Examination, and by it alone will his work be known to the Examiners, or re-arranged in the event of any accidental mixture or displacement of the papers. Cards bearing numbers corresponding with those at the head of the forms, will be sent from this office to you for distribution to the respective candidates.

You will have the goodness to keep a list of the Candidates, *with the number of each opposite his name*, for reference in case of difficulty. A copy of the list should also be hung up, in some conspicuous place, in the Examination Room, which may be specially consulted by the Candidates on the days of the Final Examination.

Detailed instructions (Form No. 5) as to the regulations adopted by the Board to secure uniformity and fair dealing in the arrangements for the Final Examination, will be hereafter forwarded to you.

I am, Sir, your obedient servant,
——————, Secretary.

FORM No. 4.—Candidate's Return.

1. Candidate's name, in full______________
2. Age last birthday______________
3. Residence______________
4. Occupation (present or proposed)______________
5. Member of______________Institution.
or
6. Student of a Class in______________Institution.
7. Number of years at School______________
8. Number of years since leaving School______________
9. Father's name______________
10. " occupation______________

I, the above-named______________ declare that the above returns are correct, and that I desire to present myself as a Candidate at the ensuing Examination, to be held by the Board of Arts and Manufactures at______________.

N.B.—The above return must be entered by the Candidate in his own handwriting.

I HEREBY CERTIFY that the above-named ______________has passed a satisfactory previous Examination in the special subjects, opposite to which, in the margin, I have placed my initials.

Signed______________

On behalf and by authority of the Local Com. of——— } ______________
Dated this ——— day of 1860.
To ——————

FORM No. 5.—Letter of Instructions.

Board of Arts and Manufactures, Toronto.

SIR,—I am directed by the Board to inform you that the papers for the ensuing Final Examination of Candidates, for the Board's Certificates, will be forwarded by post, on ——— the ——— day of ———, in a parcel addressed to you at ———.

You will have the goodness to let me know, on ———, the ——— of ———, in time for the despatch of duplicate papers, if the parcel is not duly delivered to you by the morning of that day.

The outer wrapper of this parcel should be opened as soon as received, when you will find the papers for each evening enclosed in a separate envelope, with the number of papers in each subject endorsed upon it. *The seal of each separate envelope is to be broken in the presence of the assembled candidates, at the commencement of the time appointed* in the Time-table. This direction, as well as the *order* and *hours* of Examination laid down in the Time-table, must be *strictly* observed. It is absolutely necessary, for the proper working and ultimate success of these Examinations, that there should not be the least suspicion as to the perfect fairness and equality with which they are conducted by the different Local Committees; and such suspicions can only be obviated by the *simultaneous* opening of the separate envelopes, and by the *simultaneous* working of the *same* set of papers before each Local Committee. On this, and on the firmness and fidelity with which the members of the Local Committees discharge the simple, though somewhat onerous, duties required of them to prevent the possibility of any dishonest dealing on the part of any candidate while under examination, the success of the present system depends.

I am, therefore, to invite your most careful attention to the "Advice to Candidates" which you will find printed at the foot of the enclosed copies of the Time-table, and to the terms of the accompanying Forms of Declaration, one of which Forms will have to be filled up and returned to me, after it has been signed by at least two members of the Local Committee, at the end of each meeting of the candidates. To provide for this it will be necessary that you should immediately make arrangements with your colleagues on the Local Committee, to secure the attendance of a sufficient number of them in rotation at the different periods of the examination. The attention of your Candidates should be drawn to the Time-table now sent to you, and copies of it should be suspended in the Examination Room.

It will further be necessary that the Local Committee should provide writing paper, of foolscap size, scribbling-paper for rough drafts, and blotting paper, for the use of the candidates at the Final Examination, who should be desired to bring their own pens and a small inkstand to the examination room, but nothing else. They must be required, on entering the examination room, to give up all books, papers, memoranda, writing books, or loose blotting paper which they may have brought with them, under the penalty of immediate exclusion from the examination if any such articles should thereafter be found in their possession. After such notice the plea of accident or forgetfulness cannot be admitted.

The Time-table has been drawn up to meet the general convenience of the whole number of Candidates who will assemble at the different Local Committees; and no *variation* of the Time-table can possibly be allowed.

The Candidates should sit in the order of their numbers, as far apart from each other as the space at your command will allow. If you cannot spread them out so as to prevent the *possibility* of communications passing between them, it will be well to disregard the numerical order, and arrange alternately the candidates who take different subjects.

Three hours only are allowed for each paper.

All writing must cease at the end of the three hours, *to a moment;* and, if there is no clock in the room, notice should be given to the candidates when one and two hours have elapsed, and again when they are within ten minutes of the end of each sitting.

The candidates should leave their answers at their seats, after having carefully fastened them together, in order, through the upper left-hand corner. A supply of twine and some large needles should be provided for this purpose.

The papers should then be collected—those on each subject separately—and arranged in the order of the Candidates' numbers. After a *separate* Declaration has been filled up and signed, in reference to the papers on *each subject,* it should be tied up with them; the whole set, or sets, worked each evening should be forwarded either by letter or parcel post, in *one* parcel addressed to me at this office.

The Board regrets to have to trouble you with the observance of so many minute directions, but trust you will see the necessity of faithfully carrying them out, in order to avoid the occurrence of any mistakes.

I am, Sir, your obedient servant,

————————, Secretary.

Form No. 6—Time-table.

Examinations of the Board of Arts and Manufactures for U. C., 1861.

The Examinations will be held on the evenings of the 28th, 29th, 30th, and 31st May, 1861.

The hours of Examination will be from 7 o'clock to 10, and they must be strictly adhered to.

No Candidate will be admitted after the Examination shall have commenced.

Time Table for 1861.

No Candidate may work more than one paper in each evening.

Tuesday, the 28th May, from 7 to 10 p.m.	Wednesday, the 29th May, from 7 to 10 p.m.	Thursday, the 30th May, from 7 to 10 p.m.	Friday, the 31st May, from 7 to 10 p.m.
Arithmetic. Trigonometry Magnetism, Electricity and Heat. Agriculture and Horticulture. History. English Grammar and Composition. Penmanship.	Book-keeping. Conic Sections. Chemistry. *English Literature. Music. Geology and Mineralogy.	Algebra. Practical Mechanics. Astronomy. Animal Physiology. Political and Social Econo'y French. Drawing and Modelling.	Geometry. Mensuration. Principles of Mechanics. Botany. Geography. German.

* Two Papers of one hour and a half each in this subject are considered as one.

Advice to Candidates.

Read over the Time-table carefully, and note the hours appointed for the subjects in which you wish to be examined. Be at your seat in the Examination Room *five minutes before the hour appointed* for each Paper which you are to work.

When the Paper is given to you, *first* look to the instructions printed at the head of it, and *then* read the questions carefully over, marking those which you think you can answer best. Do them first, and if any time remains, you may try some of the others, but do not exceed the number of questions appointed to be answered. Remember, that a few accurate and sensible answers will gain a higher number of marks than a great number of indifferent attempts.

As soon as notice is given (10 minutes before the end of the time) finish your Papers, see that they are numbered rightly, and in their proper order, fasten them with twine at the upper left hand corner, and leave them UNFOLDED at your seat.

Caution.

No Candidate may speak to another Candidate, on any pretence whatever, under pain of immediate expulsion.

If a Candidate has any question to ask, or wants anything in the course of the Examination, he should not leave his place; but *should stand up and call out his number*, when some one will attend to him.

No Candidate will be allowed to resume the working of a Paper after he has once left the room in the course of the time appointed for that Paper.

Any Candidate detected in taking unfair advantages, such as referring to any Book, or Written Paper, or in seeking or receiving assistance from another, will be immediately expelled.

Whoever gives assistance will be treated in the same manner as he who receives or asks for it.

Stationery, including blotting-paper, will be furnished by the Local Committee, for the use of the Candidates. No one can be permitted to bring any book, paper, or other thing into the Room with him, except an inkstand and a supply of pens.

The Papers should be carefully and neatly written.

Ill-spelt Papers will be rejected by the Examiners.

Form No. 7.—(Declaration.)

DECLARATION.

Local Committee of____________

We, the undersigned, hereby declare that the [a]_____papers on________________[b]____which are forwarded herewith, were worked in our presence by the Candidates whose numbers they respectively bear, without any assistance whatever, from books, notes, or memoranda, from each other, from ourselves, or from any other person. We declare that not more than three hours were occupied in working these papers; that they were worked at the time appointed for them in the Time-table issued by the Board, and that no Candidate was allowed to resume or complete a paper after having left the Examination room in the course of the time assigned to that paper; we further declare that the paper of questions given to each Candidate was taken from the envelope in which it was transmitted from the Board of Arts and Manufactures, the seal of this envelope being broken in our presence, and in that of the assembled Candidates, at the commencement of the time appointed for the paper in the Time-table issued by the Board; and, finally, we declare that not fewer than*______of our number were present during the whole time that the Candidates were engaged on these papers.

Name, designation and address of members of Local Committee who were present during the working of the papers referred to in the above declaration.†

____
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____
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____

N.B.—The members of the Local Committee will appreciate the importance of this Declaration. To sign it without a certainty of its truth, would be to attempt a fraud on the Board, on the Examiners, on the Candidates, and on the public at large. The Board is confident that the Local Committees will not only act with perfect good faith, but will use such scrupulous care and caution, that errors in their "Declarations" will be impossible.

By order of the Board,

W. EDWARDS, *Secretary.*

Toronto, Nov. 1860.

ASSOCIATION OF ARCHITECTS, CIVIL ENGINEERS AND P. L. SURVEYORS OF THE PROVINCE OF CANADA.

This Association was established in March, 1859. It has for its objects, as stated in the preamble of its published rules, "the establishment of a tariff of charges for reference in cases of disputed claims, the collection and exhibition of Works of Art, Models and Drawings, articles of practical utility in the several professions, and also the meeting together at stated times for the consideration and discussion of subjects that might be of interest to the Association."

Its officers for the years 1860–'61, are:

W. THOMAS, Toronto, *President.*
GEO. BROWN, Montreal, 1*st Vice-President.*
F. J. RASTRICK, Hamilton, 2*nd* do.
S. DENNIS, Toronto, 3*rd* do.
WILLIAM HAY, Toronto, *Treasurer.*
JOHN TULLY, Toronto, *Secretary.*

Committee:

J. O. BROWNE, Toronto,	W. T. THOMAS, Toronto.
H. McLEOD, London,	S. PETERS, London,
A. H. HORSEY, Kingston.	J. H. SPRINGLE, Montreal,
W. KAUFFMAN, Toronto,	THOMAS GUNDRY, Toronto,
F. F. PASSMORE, Toronto.	JOSEPH SHEARD, Toronto.

Its meetings are held on the first Wednesday of each month from October to May, inclusive, at three in the afternoon, in the Rooms of the Board of Arts and Manufactures, King Street, Toronto.

CANADIAN PATENTS,

As issued by the BUREAU OF AGRICULTURE AND STATISTICS, from 1st. July, to 6th. October, 1860:—

James Alexander Campbell, of Georgetown, county of Halton, Printer, for "A Card Press and Mailing Machine.—(Dated 4th July, 1860.)

William Bowman, of the city of London, county of Middlesex, Engineer, for "An iron surface bearing fish or joint plate for Railways.—(Dated 4th July, 1860.)

Samuel Morse, of the town of Milton, county of Halton, Machinist, for "An improved combined Reaping and Mowing Machine.—(Dated 4th July, 1860.)

Charles Carlton, Waggon Maker, and Joshua Carlton, Blacksmith, both of the township of York, county of York, for "An improved Seaming Cultivator.—(Dated 4th July, 1860)

John Worthington, Builder, and John Brown, Modeller, both of the city of Toronto, county of York, for "The discovery of a 'Composition' for the manufacture of Fire Bricks."—(Dated 4th July, 1860.)

The Reverend James Spencer, of the city of Toronto, county of York, Wesleyan Minister, for "A machine for printing words, names, numbers, dates or addresses upon papers, pages, books, tickets, periodicals and other articles requiring to be marked, printed or addressed."—(Date of *re-issued* Patent 6th July, 1860.)

Charles Meadows, of the township of East Zorra, County Oxford, Yeoman, for "An improved machine for sawing firewood from the log."—(Dated 6th July, 1860.)

Phillip D. Eckardt, of Unionville, in the Township of Markham, County York, Carriage maker, for "A Root Slicer."—(Dated 9th July, 1860.)

Henry P. Griggs, of the Town of Port Hope, County Durham, Physician, and Surgeon, for "An Empire Thermometer Churn."—(Dated 9th July, 1860.)

Charles B. Brown, of the Town of St. Thomas, County Elgin, Machinist for "A plaster, Dry Manure and Grain Sower."—(Dated 23rd July, 1860.)

Edward John Maxwell, of the City of Montreal, Carpenter, for a "Double Action Flush Window Bolt."—(Date of *re-issued* Patent 25th July, 1860.)

Samuel John Kelso, of Chicoutimi, County Chicoutimi, Agent for an "Aqua-Gravitation Engine."—(Dated 26th July 1860.)

(*a*) Insert Number, (*b*) Insert subject.
* State the number, which in no case must be less than *two.*

† This declaration must be signed, in every case, by, at least, *two* of the members of the Local Board; and, when more than twenty Candidates are examined at any one sitting, by, at least, *three* such members. It must not, in any case, be signed by a member of the Board from whom any of the Candidates have received instruction in the subject of the paper to which it refers.

Joseph B. Palser, of the city of Montreal, Paper Manufacturer, for an improved and useful article of manufacture, termed and denominated by him, "Staple Fibre."—(Dated 26th July, 1860.)!

Lewis House, of the village of Beamsville, County Lincoln, Machinist, for a "Corn Sheller."—(Dated 2nd August, 1860.)

Henry Yates, of the Town of Brantford, County Brant, Mechanical Engineer, for an "Improved perforated Fire Grate, Feed Water Heater and Damper Combined," for Steam Engines.—Date of *re-issued* Patent 2nd August, 1860.)

Andrew Bridge, of West Brook, in the Township of Kingston, County Frontenac, Cooper, for a "Self-acting Churn."—(Dated 2nd August, 1860.)

Hiram Broadbent, of the city of Hamilton, County Wentworth, Brass and Iron Founder, for "Improved Stop-Cocks, Plugs and Valves," for the passage of Water and other Fluids.—(Dated 2nd August, 1860.)

William Welch, of the city of Hamilton, County Wentworth, Engine Driver. for a "Spark Annihilator."—(Dated 2nd August, 1860.)

George White, of the village of Newmarket, County of York, Blacksmith, for "An improved Straw Cutting Box."—Dated 7th August, 1860.)

Joseph B. Palser, of the city of Montreal, Paper Manufacturer, for "An improved apparatus" to be used in the manufacture of Paper Pulp from straw and other fibrous materials.—(Dated 8th August, 1860.)

Cornelius James Scott and Samuel Dustin, Lockwood, both of the township of Camden, County of Addington, Farmers, for "An improved Harvesting Fork,"—(Dated 25th September, 1860)

Hiram Marlatt, of the village of Thorold, County of Welland, Gentleman, for "A Fruit Picker."—(Dated 25th September, 1860.)

Isaiah Tyson Smith, of the Town of Belleville, County of Hastings, Miller, for "Smith's perfect system of Mill Stone Dressing by a Diamond."—(Dated 25th September, 1860.)

Horace Brown, of the Township of Bastard, County of Leeds, Miller, for "A new method of balancing Mill Stones,"—(Dated 25th September, 1860.)

Charles Wilson, of the Village of St. Mary's, County of Perth, Trader, for "A Grain Separator."—(Dated 25th September, 1860.)

John Davis, of the Town of Chatham, County of Kent, Machinist, for "An Hydraulic Bellows, "—(Dated 25th September, 1860.)

James Paton Clarke, of the City of Hamilton, County of Wentworth, Professor of Music, for "A Reaping and Mowing Machine, termed the Scythe Reaper and Mower."—(Dated 25th September, 1860.)

James Findlay, of the City of Toronto, County of York, Engineer, for "A Branch Rail, termed, Findlay's Branch Rail,"—(Dated 25th September, 1860.)

John William Henry Schneider, of the Township of Barton, County of Wentworth, for a "Safety Check," for the more effectual management of kicking, run-away and otherwise unruly horses.—(Dated 25th September, 1860.)

John Langstaff, Junior, of the Township of Markham, County of York, Machinist, for "Wooden Eave Trough, or Water Conductor,"—(Dated 25th September, 1860.)

Charles Horatio Waterous, of the Town of Brantford, County of Brant, Machinist, for "A new mode of packing and preserving Hops."—(Dated 25th September, 1860.)

Robert Might, of the Village of New Hamburg, County of Waterloo, Machinist, for "An improved mode of constructing Threshing Machines."—(Dated 25th September, 1860.)

Thomas Towell, of the Township of Seneca, County of Haldimand, and William Gunson, of the Township of Glandford, County of Wentworth, Machinists, for "An improved Cultivator and Thistle Cutter."—(Dated 25th September, 1860.)

George McKenzie, of the Town of Goderich, County of Huron, Carriage and Waggon Maker, for "An improved Pipe Bush."—(Dated 25th September, 1860.)

John Yerks, of Charlotteville, County of Norfolk, Mechinist, for "An improved Root Cutter."—(Dated 25th September, 1860.)

Samuel Morse, of the Town of Milton, County of Halton, Machinist, for "An improved Threshing Machine."—(Dated 25th September, 1860.)

William James, of Mariposa, County of Victoria, Farmer, for "A Double action Dash Churn."—Dated 25th September, 1860.)

William Weir, of the City of Montreal, Publisher, for "Improvement in the manufacture of Paper Pulp from straw or other vegetable substances."—(Dated 2nd October, 1860.)

Norman L. Webster, of Richmond, County of Richmond, Blacksmith, for a new and improved Furnace, to be called "Webster's Furnace."—(Dated 2nd October, 1860.)

Joseph Paradis, of the Parish of St. Judes, Machinist, for "An improved Water Wheel."—(Dated 3rd October, 1860.)

Joseph B. Palser, of the City of Montreal, Paper Manufacturer, for certain new and useful "Improvements in the manufacture of Paper Pulp from straw and other fibrous materials."—(Dated 3rd October, 1860."

Matthew Moody, of the Parish of Terrebonne, Machinist, for "An Accommodating Joint," working on two centre bearings, applied to Mowing and Reaping Machines."—(Dated 4th October, 1860.)

Charles Brooks, of the Township of Ascot, Merchant, for a Self-acting Carriage Brake."—(Dated 4th October, 1860.

Frederick Lane, of the City of Montreal, Gentleman, for "A new and improved Galvanic Battery and Electric Helix."—(Dated 6th October, 1860.)

Selected Articles.

STARCH.

Every Farmer in Canada should understand the process of manufacturing Starch from potatoes. It frequently happens that large quantities of spoiled potatoes accumulate during unfavourable seasons, and in remote districts where the market price is not remunerative. If they were converted into starch, a market would be found at once, and the product is so portable that its conveyance would be a trifle compared with its value, which in England is $100 a ton. The following article is deserving of general attention.

ON STARCHES, THE PURPOSES TO WHICH THEY ARE APPLIED, AND IMPROVEMENTS IN THEIR MANUFACTURE. *

At the beginning of this century, starch was used only in the laundry, for the toilet, and, to a limited extent, as diet, whilst now a great variety of starches have been introduced into commerce, and, by certain

* By Dr. F. Grace Calvert, F.R.S., "Journal of the Society of Arts

processes, which I shall hereafter describe, converted into gum or sugar, and thus have become used in manufactures; and to give an idea of the immense quantities used in Lancashire, especially at print and bleach works, I may mention that at one single print works, in Manchester, above 300 tons of these products are used annually. One of the great chemists of the day has made the curious remark that this most important diet of man is often associated in plants with acrid or poisonous substances; thus, for example, in the wild chesnut, the starch is mixed with an acrid substance. In the roots of the *arum*, starch exists conjointly with an acrid and venomous substance; and in the root of the manioc it is mixed with prussic acid. But the Deity has given to man an intuition which enables him to separate the starch with facility from its poisonous accompaniments. Thus the natives of Guiana and of the West Indies have found out that by heating the roots of the manioc, the prussic acid was dissipated and the tapioca obtained.

A most interesting fact is, that although the globules of these starches vary in size from the thousandth of an inch to the three-hundreth, as in the case of potato starch, and the other part or shell has a different molecular arrangement from the internal part, still they have been proved by analysis to have all the same ultimate composition when pure and dried at 220° Fahr., viz., $C_{12}\ H_9\ O_9$ or 72 parts of carbon, and 81 of water. All starches except Inuline give a blue color when iodine, and if the compound be mixed with water and heated, the color disappears, though, strange to say, it returns when the solution cools. M. Payen has recently discovered a method of rendering this splendid color comparatively permanent, and, as this discovery may result in some useful applications, I think it right to state that the best way to produce it is to leave some potato starch in contact with ammonio-oxide of copper for several hours, washing the excess of the latter away, boiling the green precipitate which remains, and adding to it a solution of iodine, when a splendid purple precipitate will be formed. *

The globules of starch when heated in water, swell, burst, and are then found to be composed of successive concentric layers, but the outer layer has a different molecular arrangement from the internal ones; for M. Payen has found that these parts have different degrees of solubility in ammonio-oxide of copper, and has further observed that the outer envelope will swell to 1,000 times its original size when placed in contact with the above fluid. Starches are highly hygrometic; thus ordinary potato starch can combine with 3, 5, 11, and 16 equivalents of water. The starch, as extracted from the potato, contains 45 per cent., 25 per cent, when kept in a damp atmosphere, and 18 per cent. when stored in a dry place; and it is easy to distinguish starch which contains (say) 18 per cent. from that which contains 35 per cent., by placing a small piece on a metallic plate heated to 212 degrees, when the starch with 18 per cent. will fly about, whilst that with 35 will agglomerate and form hard lumps; in fact it is by means of this property of potato starch that large quantities of artificial tapioca are made on the continent.

Although I shall refer, further on, to the curious transformation of starch into sugar by the action of acids, I may here state that M. Fremy has demonstrated that the sweetening of fruits is due to the action of the acids converting the starch existing in them into sugar, and that N. Niépce de St. Victor has recently made the curious observation that when paper is impregnated with starch, and exposed to the rays of the sun, the starch is slowly converted into sugar. Diastase, or an albuminous ferment, which exists in all grains, but especially in malt, possesses also the same property to a high degree, more particularly at a temperature of 150° Fahr., as proved in the mash-tub of the brewer; and I am gratified to find that the suggestion which I made thirteen years ago, viz., that this temperature should not be exceeded, is now generally acted upon by brewers, who find that a higher temperature annihilates the converting power of diastase and thereby causes serious loss.

One of the greatest triumphs of chemistry applied to physiology has been the discovery of diastase in the saliva and pancreatic juice in the human system, by which the starch taken as food is converted into an isomeric substance called glycogene, stored by the liver and there converted, according to the requirements of vitality, into sugar, and carried by the circulation of the blood into the capillaries, where it is converted into water and carbonic acid, producing the heat necessary for the maintenance of life. Chemists have also discovered the presence of starch or a substance isomeric to it in the skeletons of many of the invertebrata, such, for example, as the crustacea, arachnida, and insects, and the envelope of certain tunicate molusca; and Messrs. Berthelot and Piligot have recently placed this interesting fact beyond doubt.

Starch presents not only a great similiarity of composition to the fibres of plants, such as flax and cotton, but, when treated with concentrated nitric acid, it is also transformed into fulminating substance, called Xyloidine, similiar to gun cotton.

Although time will not allow me to enumerate all the various starches known, I think it advisable to mention the principal kinds used in commerce. They are:—

Arrowroot, obtained from the roots of the *Maranta arundinacea*, in the East and West Indies, by pounding in mortars, and elutriation through sieves.

Sago, obtained from the pith of the sago palm, which grows in the Molucca and Phillipine Islands.

Tapioca, obtained as above stated from the manioc root (*Jatropha Manihot*).

Inuline, or starch obtained from the dahlia root.

Millet starch, obtained from the *Paniacum Miliaceum*.

Rice starch.

Wheaten starch.

Fecula, or potato starch.

Wheaten Starch.—The starch in wheat is associated with a most curious elastic and azotised substance, called gluten, the quantity and quality of which in the wheat determine the nutritive and commercial value of its flour, and it is only very recently that this substance, which has generally been considered as a waste product, has received a valuable application in calico printing. An eminent chemist and calico printer of Glasgow, Mr. Walter Crum, has discovered that under certain circumstances, gluten is soluble in weak alkali, and thus has applied it as a substitute for albumen for fixing on muslins a beautiful purple mauve color, called French purple.

* See comptes Rendus de l'Académie des Sciences, 1859.

Thus the two principal ingredients of wheat, gluten and starch, are used in calico printing, the gluten for some colors, and the starch for others.

The usual mode of obtaining starch from wheaten flour is to place some flour or crushed wheat, with water, in large tubs or vats, allowing it to enter into fermentation, and to continue fermenting for several weeks, according to temperature. In well-conducted establishments this operation is carried on in rooms heated in winter, so as to allow the fermentation to proceed without interruption. The fermentation of the grain produces a foul acid water called *sour water*, and the putrefaction of the azotised substance of the grain gives rise to a very offensive odor. The sour water contains alcohol, acetate of ammonia, acetic and lactic acids, biphosphate of lime, and decomposed gluten. The fermentation which first occurs is the vinous, at the expense of the sugar and a certain portion of the starch; carbonic acid and alcohol are thus formed. The former is evolved, and the latter remains in the liquor. The alcohol is rapidly transformed, under the influence of the oxygen of the air and the gluten, into acetic acid, and it is by this acid thus formed, conjointly with lactic acid, that the complete separation of the starch and gluten is effected. The ammonia comes from the decomposition of the gluten, and the lactic acid is a secondary product arising from that of the starch. But still the fermentation and the acids are not sufficient to remove or destroy the whole of the gluten, which forms a layer on the top of the starch; this mass, called *slimes* or *flummery*, was formerly used for feeding pigs, but is now employed by calico printers in their *resist pastes*, and by the patent gum manufacturers in the preparation of certain of their products. The slimes and the other results of decomposition above enumerated are removed by washing and by sieves from the starch, when this is allowed to settle in clear water for several days so as to acquire a sufficient consistency. If the starch is to have a blue tint, called Poland, fine ultramarine must be mixed in the liquor of the last sieve, in the proportion of about 2 per cent. It is then either placed on cloths to drain, or put in wooden chests, the bottoms of which are lined with cloth; this operation is called *boxing*. When sufficiently drained it is dryed by various means, and then the masses are broken into lumps of about six cubic inches, wrapped in paper, and placed in carefully heated stoves, when, strange to say, these masses split up into thousands of irregular pieces, well known to consumers. Potato starch and all those similiar to it cannot assume this peculiar form.

The above fermentation process is not only objectionable from the length of time it requires, and the noxious products which arise from it, but also from its serious destruction of valuable materials, which amounts to between 30 and 40 per cent. Mr. Martin, of Paris, succeeded some twenty years ago in doing away with the above inconveniences, by kneading the flour into dough, and introducing it into a wooden cylinder, working on its axes and armed with cutters, and having its openings covered with a fine copper gauze. By this means Mr. Martin obtained a larger yield of starch, and saved the valuable substance called gluten, which he turned to good account by drying it, pulverising it, and selling it as granulated gluten; it is now sold in London under the fictitious name of *semolina*. He also, by adding gluten to flour, brought the latter into a state to be easily manufactured into macaroni and similar pastes. To separate the small amount of gluten which the starch still contains, Mr. Martin allows it to ferment for several days, or treats it with chemical agents, which separate the gluten from the starch. Wheaten starch is not only employed for domestic purposes, but is also used extensively by calico printers, especially for thickening colours into the composition of which free acids enter. A similar supply of starch can be obtained from rye, barley, oats, buckwheat, millet, and maize.

To obtain their starch, potatoes are washed in a suitable machine, to remove all dirt; they are then reduced to pulp by rasping, and the pulp is elutriated upon a fine wire sieve, and, by successive similar operations, the starch is separated from the pulp. After having been drained in boxes, lined with felt, it is then placed on dried floors, made of plaster of Paris, which absorbs the greatest part of the water, and, to complete its desiccation, it is further dried in the air and in stoves. The farina so prepared, although suitable for manufacturing purposes, has still a peculiar rank taste, which renders it disagreeable as food. To remove this nauseous odour and taste which it possesses, Mr. Martin washes the starch with a weak solution of carbonate of soda, which renders it perfectly sweet.

Besides its application as above in the manufacture of artificial tapioca, and as a substitute for arrowroot, it is also used in large quantities in print works for thickening colours, and finishing goods, and also as a substitute for wheaten flour in laundry purposes. The Glenfield Company, as I believe, were the first to introduce a preparation of farina which has the advantage, when boiled with water, of forming a clear fluid, which gives to net and other fine fabrics a transparent appearance, instead of an opaque one. This the company effects by mixing with the starch a trace of sulphuric acid, which still is sufficient to convert the insoluble starch into a soluble substance, called *dextrine*. A process has lately been patented to effect the same change by means of oxalic acid.

Recently Mr. Sorel has published a most interesting application of starch, which consists in producing an artificial substance, capable of replacing in many instances, ivory, horn, gutta percha, &c. He obtains his new plastic and translucent matter by adding farina to a solution of chloride of zinc, of such a strength as to swell it out without dissolving it. This mass becomes hard and tenacious, and to modify these properties various substances, such as oxide of zinc and sulphate of baryta, are added in a powdered state; and what is curious is that, whilst oxide of zinc renders the mass opaque, sulphate of baryta does not affect its translucent appearance.

The extension which took place in calico printing, some 20 or 30 years ago, called into consumption such large quantities of gum arabic, that farina heated to a temperature of 250 to 300 degrees, and thus rendered soluble as a gum, became extensively employed as a substitute, and of late years it has assumed an important place in the list of materials used by calico printers. To effect this curious change at the present day, farina is heated to the above temperature, either in a revolving cylinder or in iron troughs placed in a stove for several hours, when it acquires an umber colour and becomes soluble in water. This change is entirely a molecular one, as the raw and calcined farina have the same composition, notwith-

standing which farina gives a blue colour with iodine, and when calcined a purple. As the colour of calcined farina is an objection to its employment in many instances, it was a great desideratum to find a process for its conversion, at such a low temperature, as to leave the converted farina nearly colourless. This was first effected in 1838, by M. Payen, who found that if to 400 parts of dry farina one part of nitric acid at 1·40 was added, after having been diluted with sufficient water to form with the farina a hard paste, and this then dried slowly and heated in a close chamber for 20 hours, at a temperature of 200 deg. Fahr. a nearly white farina was obtained. It is interesting to observe how so small a quantity as a few thousandths of acid can effect this great molecular change. Since that time, many processes have been devised to attain the same end, and you will remember that, in a paper which I had the honour to read here some years ago, I adverted to a method discovered by Mr. Edward Hunt and I have now the satisfaction of calling your attention to a very interesting process discovered also by one of my late assistants, Mr. Charles O'Neil, and which is valuable as it enables him to convert insoluble farina into soluble farina, or *dextrine*, without any change of colour. This he effects by subjecting starch, farina and other amylaceous substances to the chemical action of muriatic acid gas, or other acid gas or vapour in a cylinder, the exterior of which is surrounded by an atmosphere of steam. This beautiful preparation will extend the employment of soluble farina as a substitute for gum arabic, the colour which was inseparable from farina previous to this discovery excluding its use in many instances. As calico printing in its present extraordinary development requires thousands of tons of soluble materials for thickening the mordants and colours used, a great variety of this class of artificial gums are prepared so as to meet these requirements. Thus, besides farina, sago, rice, slimes and wheaten flour are used ; the latter when heated generally bears the name of British gum, which differs from calcined farina in being soluble in water only at a boiling temperature.

If, instead of employing minute quantities of acids, a larger quantity be used, farina and other starches are not only first transformed into gums, but are further converted into sugar, similar to that which exists in grapes and fruits generally. But, in this case, starch undergoes not a mere molecular change, but a complete chemical transformation, by fixing two equivalents of water. On the Continent, where large quantities of this peculiar sugar are employed in the preparation of beer and other beverages, the following process is now adapted. By adding farina gradually to one part of vitriol diluted with 33 parts of water, and carrying the whole to the boil for 30 or 40 minutes, it is converted into sugar, and this is easily ascertained, as that solution yields no colour with iodine. To the solution is then added carbonate of lime or chalk, which forms an insoluble sulphate of lime. It is then sufficient to pour off the saccharine solution and evaporate it to a proper consistency to obtain, after cooling and standing several days, solid masses of sugar, very similar in appearance to honey.

If, instead of continuing the action of sulphuric or other acids upon starch until it is converted into sugar, the operation is stopped as soon as the solution gives a purple colour with iodine, then, by removing the acid, and evaporating the solution, a translucent soluble matter is obtained, having the greatest resemblance to gum, called *Dextrine*. Although the conversion of starch into sugar has been known for a long period, still it is only since 1833 that chemists have been aware how this curious conversion was effected. In that year, Messrs. Payen and Persoz succeeded in extracting, by means of alcohol, from a solution of malt the curious ferment which caused that change, and they gave to it the name of *diastase*. To leave no doubt that this is the agent which converts starch into sugar, they found that by mixing one part of this azotised substance with 2,000 parts of farina and a sufficient quantity of water, these were completely converted, first into, dextrine and then into sugar, at a temperature of 150° Fahr. And, as I observed at the commencement of this paper, this conversion was completely prevented if the temperature was raised to 200° or 212°.

In the discussion which followed the reading of the foregoing paper, many interesting facts were adduced, some of the most useful are given below.

In 1852 Mr. Braithwaite Poole, in his work on the Statistics of British Commerce, had estimated the manufacture of starch in the United Kingdom at about 20,000 tons, which, at an average of £23 per ton, would give a total value of £460,000 per annum. But this scarcely took into account at all the dextrines or gum-substitutes which had mainly grown into importance with the progress of textile manufactures, and were certainly 4,000 to 5,000 tons a year.

In Belgium not long since, a premium of £400 was offered for any substitute suitable for the production of starch, other than a food product. In France, the horse chestnut, which was to be had in abundance, was now converted into excellent starch and vermicelli. Many neglected tropical roots and seeds might be turned into starch ; there were hundreds available to be met with in various quarters, and it only resolved itself into a matter of cost of manufacture and price to be obtained to cover shipment, &c.

The so-called arrowroots of commerce are of a very varied character, and were obtained not only from many sources, but from very different plants ; indeed it is impossible to state what are the sources of many of the African and Indian arrowroots of the present day. The *canna* or arrowroot tribe, yielded the best from the West Indies ; but the *arums*, *curcumas*, and *cassavas*, and the sago, and other palms yielded starches, which are no doubt, bleached and rendered more saleable.

In the United States, maize or Indian corn—the great grain crop of the country—formed the source of starch production, and the Oswego starch had some repute in the United Kingdom. The demands for manufacturing purposes were on the increase. In town of Lowell alone there were used by manufacturers, in 1855, 13,115 cwt. of starch and 1,545 barrels of flour. The last Australian advices reported that, owing to the low price of potatoes in Tasmania —an article for the production of which the colonists had been famous, the farmers had been compelled to fatten their pigs upon them, not being able to dispose of them. In many instances crops had been allowed to rot in the ground, simply because they would not realise a sufficient price to cover the expense of gathering them in. Some of the farmers, however, had bethought themselves of making starch from the potato, and had found a ready sale for the product.

There is one singular feature in the process of rice starch manufacture, viz., the variation in the time which it took to deposit the starch according to the particular state of the atmosphere, not as regarded

the temperature, but possibly the electrical condition of the atmosphere; it had been proposed to introduce an electric current into the ranges, in order to regulate the deposit.

Dr. Calvert replied to an inquiry whether he was acquainted with any good process to give to starch the power of rendering fabrics incombustible. He thought that adding 1 or 1½ per cent. of sulphate of ammonia would have considerable effect. Some processes for producing that result had been patented, but it had long been known that sulphate of ammonia was the cheapest and best substance for preventing combustibility. Messrs. Versmann and Oppenheim had recently investigated this subject, and recommended the use of tunsgtate of soda; but whether this or any other salt, such as sulphate of ammonia, was the best, was principally a question of cost. If they took a piece of cotton wool, and dipped it into sulphate of ammonia, and then dried it, it was rendered uninflamable, and he saw no practical reason why this salt should not produce the same effect when mixed with starch.

BUILDING-STONES AND PRESERVATIVE SOLUTIONS.

From the Chemical News, Nov. 1850.

However inventors may dispute, and scientific men may differ, as to the respective values of the solutions intended to preserve building-stones from decay, they, as well as Parliamentary Committees and architects, are unanimously of opinion that the continued durability of the principal of our public buildings depends on chemistry. The question is one of grave importance; not merely on account of the pecuniary considerations involved, though they are of enormous magnitude; but the character of the nation is concerned in its ability to erect buildings which shall endure to future ages. The present condition of that splendid monument of the late Sir C. Barry's genius—the Houses of Parliament—is even more serious than is generally supposed. Not only do the ornaments crumble and decay, and the surfaces of the stones yield to atmospheric influences, but there is reason to apprehend that this disintegration extends to internal portions of the walls. It is not long since a policeman had a narrow escape of being killed by the falling of the canopy of the niche in which the statute of Charles II, is placed, and the cause assigned is the decay of the stone. The susceptibility of the stone employed in this building to moulder on exposure to the atmosphere is aggravated by the elaborate ornamentation to which it has been subjected. In the case of the flat surfaces, we are told that care has been taken, as far as possible, to hew the stone in such a way as to expose that side to the air which is most capable of resisting its influence; but, as regards the sculptured portions, such precaution was manifestly impossible; hence the reason why these portions exhibit the greatest amount of decay. Considering how large a proportion of the external surface consists of these ornaments, it is clear that if this crumbling becomes universal, their restoration will be almost tantamount to the re-erection of the building, which, seeing the enormous sum that has already been expended, is a contingency which may well make the economists who sit within its walls to tremble.

Before we consider the different preservative solutions which are proposed to remedy this tendency to decay in certain stones, we will briefly describe the nature of those which are available for architectural purposes; so that the causes of decay and the mode of preservation may be better understood. Among the stones which promise the greatest degree of durability is granite; not that it is entirely unsusceptible of alteration, since the crystals of felspar contained in it are liable to decomposition from the action of the carbonic acid held in solution of rainwater. But if this were the only objection to its use, we should attach little importance to it, the verticle position of the stones in a building rendering it impossible for the rain to remain on them sufficiently long to exercise a seriously injurious action, the roughening of the surface observable in very old erections of this material being attributable rather to the mechanical action of the falling rain, than to a chemical action arising from the carbonic acid contained in it. There is, however, a more serious objection to the employment of granite than this, and this is its cost. Of course this does not arise from any scarcity of the material, but from its excessive hardness, which renders it difficult to work; and for the same reason it could not be employed in buildings of a florid style of architecture. There are freestones, which are scarcely inferior to granite in hardness and durability, but these very qualities tend to prevent their general use. The Crayleith stone, which is a good deal used in Edinburgh, is of this kind. It is composed of fine grained quartx and mica, cemented together by a hard, siliceous compound. A similar kind of stone is that used in paving London streets, which is got chiefly from Yorkshire, and is very hard. It is a laminated stone and is liable to flake off when exposed to the wet. There is an instance of this tendency to be seen in the south-east corner of Victoria Square, where the action of the water has had full opportunity of developing itself, with little interference from other causes, very few people indeed walking over it. These sandstones are of different qualities, some being much harder than others; but their lamination would prevent their use in buildings where the ornamentation was elaborate, even if there were not the further objection of hardness. Moreover, in the case of those where carbonate of lime or clay forms the cement which binds the particles of quartz and mica together, the impurities contained in the rain which falls over large cities readily act upon them by dissolving the cementing medium, and consequently destroying the adhesion of the particles of which the stone is composed.

Some of the best building materials at our disposal are the limestones. First in beauty is marble; but its scarcity, and consequent dearness, renders it unavailable for general purposes. Still it may be questioned whether, if it had been foreseen that the Houses of Parliament were to begin decaying before they were finished, it would not have been cheaper in the end to have built them of this stone, seeing that it does not absorb water, and is not acted upon by it unless it contains an acid, so that decay is a thing hardly to be thought of. As to the difficulty of obtaining it in sufficient quantity, that might have been overcome by resorting to other countries. We import considerable quantities of Caen-stone from Normandy, and the expense of freight would not be greatly increased by sending vessels to the Mediterranean, close to the shores of which marble could

be quarried to almost any extent. Resembling marble, but containing veins of foreign substances which both weaken it and interfere with its working is the stone termed by geologists carboniferous limestone, but more commonly Portland-stone. This was used by the late Sir C. Barry for the beautiful building he erected at Birmingham, known as King Edward's Grammar School, the design of which is similar to that of his great work at Westminster. It has stood for twenty-five years without showing any signs of decay, except on the undersides of the cornices, string-courses, and projections in the bed-joints, arising from the drip of rain. The quarry from which this was taken is the Darley Dale, and we are assured, by an authority on whom we can rely, that no stone used in Birmingham has withstood the action of the gases contained in the air so well as this. If we judge by experience of the durability of stone, which, after all, is the best test, we presume there are few who will deny that Portland-stone is that which, in this country, should be employed for our public buildings. Look at Somerset House, some of the City churches, and Greenwich Hospital. They do not offer any signs of decay, notwithstanding the length of time which they have been exposed to the influences of the weather. The composition of this stone is almost identical with that of marble, that is to say, almost pure carbonate of lime.

Caen-stone differs in quality, like all others. Some specimens are to be found in good preservation which have withstood the wear of centuries; others, again, have decayed almost immediately on removal from the quarry. We have a striking example of this in Buckingham Palace, which was no sooner finished than portions of it had to be removed and stucco substituted in its place, and to prevent the spread of the evil, the whole front has been painted. Bath-stone, which was that selected by the Dean and Chapter for the restoration of portions of Westminster Abbey,—rather, as we think, on account of the ease with which it could be carved than by reason of its cheapness,—is the worst of all. True it is that buildings can be pointed out at Bath which were built of this stone a century ago, and yet are in good condition; but these stones may have lain in the quarry exposed to the air for months before being used, and any body who desires to see the difference which this makes in the hardness of the stone, has only to cause a block which has been left under these circumstances to be turned over, and then try the point of his knife alternately on the side which has been exposed to the air, and that which has been in contact with the ground. Probably everybody has heard of the rapidity with which the restored parts of the Abbey reverted to their original condition.

Magnesian limestone is that used in building the Houses of Parliament. When thoroughly crystalized it contains equal parts of carbonates of magnesia and lime, and in this state is generally very durable. The Commission appointed to select the stone were shown buildings composed of magnesian limestone from Bolsover, which had stood for ages, and they decided in favour of the same material. So far they were justified in their selection; but it may be questioned whether, when it was found that this quarry did not contain anything like sufficient stone for the purpose, a similar stone from other quarries should have been accepted, without first submitting it to a rigorous examination. There can be no doubt that had proper care been taken in inspecting each block as it was hewn in the quarry, and it had been properly hardened by exposure to the air, and protected from rain, the present alarming condition of the building would never have arisen. The absorbent properties of these stones facilitate the action upon them of the gases contained in the atmosphere; and it is only just to mention that the Houses of Parliament and the Abbey have been more severely tested in this way than any other of our public buildings, from the quantity of gases vomited from the chimneys and factories on the opposite bank of the Thames being borne across to them whenever the wind does not blow in a contrary direction. The result of this action shows itself very rapidly in those parts of the stone where the crystallization is not complete; they become soft, and are ultimately reduced to powder. Of course the proper way of guarding against this accident is to reject those blocks in which the crystallization is imperfect; and, though this would involve increased expenditure in the erection of a building, it would be sound economy to do so.

From what we have said of the composition of stones, it will be seen that those which are best suited for buildings in the Gothic, or any similar style of architecture, are, by the possessiou of that very quality, unfit for employment in the erection of edifices subject to the action of an atmosphere like that which envelopes London and other large cities, unless they can be protected from this action by the application of a substance of some kind. All men are agreed as to the necessity of this; the point on which they differ is the kind of substance to be employed. In the case of Buckingham Palace, paint was the means adopted to arrest further decay, but the objection to paint, apart from its unsightliness, is, that it is no sooner laid on than it begins to yield to influences similar to those it is used to guard against; the oil decomposes and gradually separates from the lead, and the dirty-looking, blackened surface, slowly flakes off, and the whole process has to be gone over again in the course of a year or two. Moreover, the idea of going to the expense of raising a structure of stone, and then painting it, would be considerably more absurd than employing the same means with the view of improving the appearance of the lily. That the fronts of so many large houses in this city are painted, is owing to the use of stucco, which must of necessity be painted in order to give it a false appearance of being what it is not. To preserve stone effectually from the action of the air, and at the same time to allow it to retain its natural beauty, is the problem which chemists have to work out. How far the inventors of the different preservative solutions now in the market have attained this object, is a question which we conceive is not yet decided; at the same time, the fact that these processes are patented is an obstacle to others making researches in the same direction, inasmuch as the number of substances available for the purpose is so limited that it would be difficult to avoid what might be held to be an infringement of patent rights. The method of preserving stone by coating it with a siliceous solution was known to, and employed by the ancients. Colonel Rawlinson says, that he saw, at Behistun, a stone surface, several hundred feet in extent, which was covered with engraved characters, made about 500 years B.C., which yet offered only partial signs of decay, from having been coated with a flint varnish having the appearance of somewhat opaque glass. The discovery of a preservative pro-

cess of this kind is so simple, that there is no doubt it would have been made ages ago if our forefathers had seen the necessity of guarding against decay in the magnificent structures they raised; but it seems they must have possessed more skill, or exercised more care in the choice of their building materials than we are in the habit of doing, seeing that their edifices remain almost uninjured after the lapse of centuries, while ours begin crumbling to pieces before they are well finished.

With the discovery of the water-glass in recent times the name of M. Fuchs, of Munich, is associated; but his efforts to bring it into extensive use in England were almost ineffectual, though it probably gave the clue to the different modifications of the process now in use. Kuhlman, a French chemist, and others, took up the subject, and experiments were undertaken with the view of making the discovery available in protecting stone, wood, and even mortar used in sub-aqueous works, from decay. All the processes employed are based on the fact that common flint is soluble in a caustic alkaline solution, at a very high temperature, say of 300° Fahr., or thereabouts. This solution is as easily applied to a surface as though it were water; but when so applied, an exposure for a greater or less period,—but in no case a very long one,—renders it extremely hard. The new surfaee would be a hydrate of silica, and, as such, would be liable to the action of the alkaline carbonates contained in the atmosphere; but it is asserted by Kuhlman that when this solution is laid on stone there is a further decomposition, the result of which is to coat it with a silicate of lime, which is not susceptible of this action.

There is room for doubt whether this really does take place in Kuhlman's process; but, as regards Ransome's, there can be no doubt about it, inasmuch as it is obtained by applying two different solutions, the result of which is to produce silicate of lime by double decomposition. His method consists in applying the silicate of soda, prepared in the manner described above, to the stone, and then laying on a solution of chloride of calcium. The result is that silicate of lime is formed, which attaches itself to the stone as closely as silver does to a copper plate in electrotyping, and common salt, which is washed off. Theoretically, nothing could be more certain and perfect than this result; but the experiments tried with it at the House of Parliament seem to prove that in practice it is not altogether so free from defects as it ought to be. Thereason of these partial failures, however, we ascribe rather to the conditions under which the experiments were made. At the lectures delivered at the Royal Institution, specimens of stone operated upon by this process were exhibited by Professor Ansted, which were all that could be desired.

Szerelmey's process is so far a secret that it has never been described by the inventor; but, from what has been ascertained, it seems that it differs from Kuhlman's only in the subsequent application of a bituminous solution, or, at any rate, in the addition of bitumen at some stage of the process. Whether this is merely to protect the stone from the atmosphere while the silicate of lime is in course of formation, or whether it enters into the composition of the preservative solution and becomes a constituent part of it, we are, as yet, unable to say. Flint itself, it is said, contains a small portion of bituminous matter, to which it owes its colour, and, therefore there would be no difficulty in adding a little more, if such a course were found advisable. Whatever preservative process may ultimately be preferred, this is accepted as the best at present, but time alone can determine whether it really is so or not. In the letter written by "An Architect," it is stated that the composition applied by M. Szerelmey to the walls of one of the courts at Westminster during the summer is still soft, and can be scratched of with the nail; but we do not think that this is of much importance, unless it be shown that in consequence of this softness the surface beneath continues to decay.

The reason of the partial failure in those cases where the solution has been applied, arises, we conceive, from the condition of the stone at the moment of its application. The surface was frequently rotten; and, where that was not the case, there was, in all probability, so great a quantity of moisture present in the stone that the chemical action was checked, or together prevented. It has been suggested that there was another cause of its flaking off, arising from what has been termed "nitrification"—in other words, the formation of crystals of nitrates, which is frequently observed in stone surfaces, and on the plaster which coats the walls of damp rooms. Whatever may have been the cause, there is no denying the fact that the attempts to cover the stones of the Houses of Parliament with a siliceous varnish, as Colonel Rawlinson terms it, have been almost ineffectual, chiefly, we believe, from the conditions under which it was applied, and the remedy for which we propose to develope.

It will be seen that the difference, if difference there be, between the processes described is so very trifling that the results in either case would be pretty nearly equal. The objection to Kuhlman's, that, in consequence of the slowness of the decomposition of the ingredients of which it consists, it is unfit for use in a climate so changeable as ours, where a shower of rain would probably intervene before the process was completed, and wash off the solution, is as applicable in a minor degree to all the others. But we submit that there is not the slightest necessity for incurring this risk in future. Instead of applying the solution to the building, let it be applied to the stones while in the stonemason's yard. This is a point which we have not seen mentioned in anything we have read on ths subject. We cannot conceive what difficulty there could be in cutting the stones and then leaving them under shelter, but exposed to a current of air to evaporate the moisture out of them. In this way they would become dry, and, as they dried, they would harden. The pores of the stone being thus freed from moisture, they would absorb the preservative solution into them just as a sponge sucks up water, by capillary attraction; so that it would not be merely a surface protection, which might be gradually destroyed by the mechanical action of the rain driven against it by a high wind, but a solid mass of material, alike unassailable by the chemical action of gases in the atmosphere, or by the mechanical attrition of the particles of dust and rain. This need involve no additional cost for materials, and its adoption would not only obviate the objection to the employment of soft stones, but, as we believe, actually render them preferable, as being even more imperishable than the finest marble; and in the case of magnesian limestone imperfectly crystalised, which, under ordinary circumstances, crumbles to powder, would entirely prevent this decay from being of material consequence by indurating the stone to so considerable a depth.

There is another method of applying the solution which might be even more effectual, but in the case of a large building it would greatly increase the cost, though, if it is a question between raising a building which will endure and one which will require to be renewed piecemeal, the greater outlay in the first instance will be the most economical. Suppose we are using Bath-stone: this can be sawn up when freshly quarried in blocks of any convenient size almost as easily as if it were wood. These blocks may then be placed in an air-tight vessel, and the air exhausted until the stone became desiccated; the solution being then admitted, would be forced into the pores of the stone so thoroughly that there would be no danger of ultimate decay.

We see no reason to doubt that the employment of either of the above methods of applying the preservative solution would have the effect of rendering the stone to which it is applied impervious to all injurious influences; if it be not so, then all future controversies as to the suitability of a modification of the Gothic style of architecture for our public buildings will be vain and ridiculous, and the only course open to us as a nation gifted with common sense, will be to adopt a style in which we may employ the very hardest material at the smallest possible expenditure for mere ornamentation. Hitherto it appears to have been the custom to select the design for the building in the first instance, and to make the choice of material a secondary consideration; in future, unless a perfect preservative solution is employed, it will probably be thought advisable to reverse this order of proceeding.

New Mercurial Electric Light.

The *Chemical News* of Sept. 14th gives a description of this new source of Light, and notices some theoretical objections to its general use as one of the ordinary sources of illumination.

This mercurial lamp seems to be the last improvement which was needed in order to render the magneto-electric machine of Professor Holmes of practical everyday value. By the latter instrument a two horse power engine is all that is required to grind out a perpetual, and intensely energetic magneto-electric current; whilst Professor Way's new discovery gives us an equally simple and effective lamp. The magneto-electric machine enables directly to convert motion into electricity; and this new lamp receives the electricity and converts it into light. Nothing can be simpler,—nothing can be more perfect.

The light which mercury gives when a voltaic spark is taken from it is of a very peculiar character. Unlike the light between carbon poles (the ordinary electric light) which evolves rays of every degree of refrangibility, and is consequently capable of illuminating any object with the exact colour which it is best able to reflect, the voltaic light from mercury consists of only six definite and homogeneous colours, each occupying a particular space in the solar spectrum and having wide black intervals between them. The first colour is a faint brick red, the second is a strong yellowish orange, the next a strong emerald green followed by a fainter green of nearly the same colour; then comes a rich ultramine blue, and lastly a violet. Several invisible rays in the chemical end of the spectrum are also present, but as none of these can be rendered sensible, except by special and complicated arrangements, and only one of them is capable of passing through glass at all, they need not further be referred to here. It will be seen from the above how different the mercurial light is from any of the ordinary sources of illumination.

The following details are abreviated from *the Engineer*:—" A fine stream of mercury, which can be regulated according to the battery power and the volume of light required, passes from an upper into a lower reservoir, and is made to conduct the electric current, by means of which it becomes intensely heated and partly dissipated in vapour. The vaporised mercury becomes subsequently condensed, and proceeds to the lower reservoir, whence it again issues, when the upper reservoir is exhausted and the apparatus reversed. The evolution of light by the passage of the electricity through the fluid conductor appears, however, to be due, not alone to the heating effect, but also, as in the case of the light from charcoal points, to the intensity of the current employed. The employment of a mercury stream as a conductor fulfils conditions which would probably be wanting in any other substance which could be used for the purpose of obtaining light by similar means. Thus, although some illuminating effect may be produced by heating platinum wire to whiteness by a quantity current, this conductor is deficient in those characters which enable us, by means of tension electricity, to obtain light from charcoal points, interrupted metallic conductors, and the mercury stream of Professor Way. If, on the other hand, we interrupt the wire, we obtain the electric spark which appears in making and breaking contact with mercury; but we fail to produce the heating effect upon the conductor, to which the illuminating power is partly due in the arrangement under notice. It is obvious, moreover, that the constant renewal of the conductor renders it possible to employ the current of any degree of power, and which would be otherwise inadmissable. The vertical mercury stream must be considered as composed of a multitude of conducting globules separated by an imperceptible interval, and thus affording the vivid spark which occurs in making and breaking contact with the metal. This hypothesis affords an explanation of the fact, that an equal illuminting effect cannot be obtained with a *horizontal* stream of mercury, although the later may be heated to an equal degree. It should be observed, that the apparatus of Professor Way, which may probably before long be employed in lighthouses and for signalling, is rendered airtight, so as to preclude the possibility of any injurious effect arising from escape of vaporised mercury.

Production of Valuable Manure from the Air, by MM. Margueritte and De Sourdeval.

The value of guano and most other concentrated manures consists to a considerable extent of the ammonia which they contain. As three quarters of the atmospheric air consists of nitrogen, and as hydrogen forms one ninth of all pure water, if some cheap means could be found for inducing the hydrogen of water to enter into combination with the nitrogen of the air in the form of ammonia, this valuable manure could be produced in unlimited quantities, and the agricultural products of of the world enormously increased. The efforts to do this have been, at last crowned with success, as will be seen by the following abstract of some recent continental researches.

Since the remarkable labours of Messrs Liebig, Schaltenmann and Kuhlmann, on the fertilising action of ammoniacal salts, the production of ammonia at a low price has become a problem of the highest interest to agriculture. But to arrive at this result it is necessary to obtain the nitrogen elsewhere than in the nitrogeneous matters; which may, for the most part, be employed directly as manures, and of which the limited quantities and elevated price permits in any event only restricted and costly manufacture.

Atmospheric air is an exhaustible and gratuitous source of nitrogen. However, this element presents so great an indifference in its chemical reactions, that,

notwithstanding the numerous attempts which have been made, chemists have not heretofore succeeded in combining it with hydrogen so as to produce ammonia, artificially. This result, so long desired, has been reserved for MM. Margueritte and De Sourdeval, who have obtained it by employing an agent of which the remarkable properties and neat and precise reactions have permitted them to succeed where all others had failed. This agent is baryta, of which notice has recently been taken on account of the recent applications that M. Kuhlmann has made of it in painting, but of which no person suspected the part that it was to be called to play in the development of the agricultural riches of our country. The manufacture of ammonia is based on a fact entirely new, the cyanuration of barium. It had been believed until the present time that potash and soda alone had the property of determining the formation of cyanogen; that the earthly alkaline bases—baryta, for example, could not, in any case, form cynanides.

Messrs. Margueritte and De Sourdeval have ascertained that this opinion is entirely erroneous, and that baryta, much better than potash or soda, fixes the nitrogen of the air or of animal matters in considerable proportions. It is already understood that, for the preparation of Prussian blue, the cyanide of barium presents great advantages over that of potassium, for the equivalent of baryta costs only about the one seventh of that of potash. Thus do we find practically and really obtained the result first announced by Desfosses and vainly pursued in France and England, the manufacture of cynanides from the nitrogen of the atmospheric air. This solution, so important, depends on the essential difference which exists between the properties of baryta, and those of potash; the first is infusible, fixed, porous, and becomes deeply cyanuretted without loss; the second is fusible, volatile, and becomes cyanuretted only at the surface, and suffers by volatilisation a loss which amounts to 50 per cent. After the cyanide of barium was obtained, the grand problem for Messrs. Margueritte and De Sourdeval to resolve was the transformation of the cyanide into ammonia by means at the same time simple, rapid, and inexpensive. The following is the operation:—

In an earthern retort is calcined, at an elevated and sustained temperature, a mixture of carbonate of baryta, iron filings in the proportion of about 30 per cent., the refuse of coal tar, and sawdust. This produces a reduction to the state of anhydrous baryta, of the greater part of the carbonate employed. Afterwards is slowly passed a current of air across the porous mass, the oxygen of which is converted into carbonic oxide by its passage over a column of incandescent charcoal, while its nitrogen, in presence of the charcoal and of the barium, transforms itself into cyanogen and produces considerable quantities of cyanide. In effect, the matter sheltered from the air and cooled, and washed with boiling water, gives with the salts of iron an abundant precipitate of Prussian blue. The mixture thus calcined and cyanuretted is received into a cylinder of either cast or wrought iron, which serves both as an extinguisher and as an apparatus for the transformation of the cyanuret. Through this cylinder, at a temperature less than 300° (Centigrade) is passed a current of steam, which disengages, under the form of ammonia, all the nitrogen contained in the cyanide of barium. It is impossible to forsee all the results of this great discovery. Among other things, it suggests the production of nitric acid from the air by oxidising ammonia.

Alteration of the Hardness of Iron by Magnetism.

If a piece of iron that may be readily filed is put in contact with a powerful magnet, great difficulty will be felt in *filing* when in this position.

NOTICES OF BOOKS SUITABLE FOR MECHANICS' INSTITUTE LIBRARIES.

A Course of Six Lectures on the various Forces of Matter and their relations to each other, by Michael Faraday, D.C.L., F.R.S., pp. 189.

The name of Faraday is sufficient to commend any work on Physical Science to the scientific student, but these lectures were delivered before a juvenile audience, and in order that they might be understood the more difficult technicalities of science had to be relinquished and great truths expressed in simple language, easily comprehended. This has been most admirably accomplished by Faraday and they reveal to the eye and intellect of the young lover of science, those mysteries which the harsh, although sometimes inevitable technicalities of scientific works, make them a sealed book to the great mass of readers. All is bright, clear, simple and comprehensible in these short lectures; and although subjects with forbidding names are discussed, they have been rendered attractive and suggestive by the genius of Faraday. The contents of the volume are:

I. The Force of Gravitation.
II. Gravity—Cohesion.
III. Cohesion—Chemical Affinity,
IV. Chemical Affinity—Heat.
V Magnetism—Electricity.
VI. The Correlation of the Physical Forces.

There is appended a chapter on light-house illumination—The electric light—A notice of the electric light is given on the opposite page.

Ure's Dictionary of Arts, Manufactures, and Mines; new Edition, chiefly rewritten, and greatly enlarged. Edited by Robert Hunt, F.R.S.F.S.S., &c., &c. Parts I—XII. London: Longman & Co. October, 1860.

This admirable dictionary should be on the shelves of every Mechanics' Institute Library. The present issue as far as it has appeared is a faithful record of the progress of the Industrial Arts and Manufactures, and is invaluable as a work of reference.

Advanced Text-Book on Geology, Descriptive and Industrial, by David Page, F.G.S., second edition. Blackwood and Son, Edinburgh, pp. 403, oct.

This work is intended to exhibit an elementary outline of geological science as now established by the leading workers in Britain, France, Germany and America. The main object of the author has been to render the student such assistance as will enable him to proceed in the field as a practical observer, and to read with appreciation the higher treatises, special monographs, papers and new discoveries of others. It is a very well arranged and admirably written text-book. The illustrations are numerous and good—and the glossary is ample and valuable. In a European work designed for students in Europe, the geological characteristics of American formations cannot be awarded much prominence, and therefore, as a text-book for students of Geology in Canada, the present work can scarcely be recommended without it is used subsequently to the volume which forms the subject of the following notice, and if employed as its sequel it will be found of the greatest value and interest.

Elementary Geology, by Edwd. Hitchcock, D.D., LL.D. A new edition, (31st) 1860. Ivison, Plimey & Co., Chicago and New York, pp. 430, 8vo.

Dr. Hitchcock has associated with himself his youngest son Charles H. Hitchcock, A.M., in the preparation of the thirty-first edition of this excellent Elementary Geology. The arrangement of the subject has been

greatly changed and improved, many chapters having been entirely rewritten and much new matter introduced. The first part treats of DESCRIPTIVE and DYNAMICAL GEOLOGY. II. Paloeontology. III. Bearings of Geology on religion. IV. Economical Geology. V. North American Geology. In the last chapter a more detailed description of the boundaries of American series of formations would have been very acceptible and appropriate, also a more detailed notice of Canadian Rocks would have secured a still higher appreciation in Canada than the preceding editions have enjoyed. The last edition makes this work perhaps the best text-book in Geology suitable to mechanics, and students generally, which has yet appeared on this continent.

Principles of Physics and Natural Philosophy; designed for the use of Colleges and Schools. By BENJAMIN SILLIMAN, M.A., M.D., Professor of General and Applied Chemistry in Yale College. Second Edition, revised and corrected. With seven hundred and twenty-two illustrations. Philadelphia: H. C. Peck and Theo. Bliss. 1861.

The publishers of this work inform us that the second revised and re-written edition of SILLIMAN'S FIRST PRINCIPLES OF PHYSICS OR NATURAL PHILOSOPHY, covers the whole ground included by Modern Science under its title. It aims at fulness without redundancy, and conciseness without obscurity, and to present all the principles of the science in clear and exact Propositions, mathematically demonstrated. The design of the author has been to present all parts of his subject with harmonious proportions, and still to keep the volume within the limits of time usually assigned to these subjects in the higher Seminaries of learning in the United States.

No pains have been spared to illustrate the work with a great abundance of carefully selected and excellent wood cuts, many of which are original.

The work is comprised in about 725 pages, small 8vo., containing upwards of 700 illustrations. The retail price is $2.25 per copy. Its contents are:—

PART I.—PHYSICS OF SOLIDS AND FLUIDS.

CHAPTER II.—GENERAL PRINICIPLES — Sec. 1. Definitions and General Properties of Matter; Sec. 2. Of Motion and Force. CHAPTER III.—Sec. 1. Direction and Centre of Gravity; Sec. 2. Laws of Falling Bodies; Sec. 3. Measure of the Intensity of Gravity; Sec. 4. Mass and Weight; Sec. 5. Motion of Projectiles. CHAPTER IV.—THEORY OF MACHINERY — Sec. 1. Machines; Sec. 2. Mechanical Powers; Sec. 3. Strength and Power; Sec. 4. Impediments to Motion.

PART II.—THE THREE STATES OF MATTER.

CHAPTER I.—MOLECULAR FORCES. CHAPTER II.—OF SOLIDS—*Molecular Forces acting between Particles of like kinds*—Sec. 1. Properties of Solids; Sec 3. Crystallography; Sec. 3. Elasticity; Sec. 4. Strength of Materials; Sec. 5. Properties of Solids depending on a permanent displacement of their Molecules; Sec. 6. Collision of Solid Bodies. CHAPTER III.—OF FLUIDS—*Hydrodynamics*—Sec. 1. Hydrostatics; Sec. 2. Hydraulics. CHAPTER IV.—OF ELASTIC FLUIDS, OR GASES—Pneumatics. CHAPTER V.—OF UNDULATIONS—Sec. 1. Theory of Undulations; Sec. 2. Undulations of Solids; Sec. 3. Undulations of Liquids; Sec. 4. Undulations of Elastic Fluids. CHAPTER VI.—ACOUSTICS—Sec. 1. Production and Propagation of Sound; Sec. 2. Physical Theory of Music; Sec. 3. Vibration of Air contained in Tubes; Sec. 4. Vocal and Auditory Apparatus.

PART III.—PHYSICS OF IMPONDERABLE AGENTS.
LIGHT. HEAT AND ELECTRICITY.

CHAPTER I.—LIGHT OR OPTICS — Sec. 1. General Properties of Light; Sec. 2. Catoptrics, or Reflection by Regular Surfaces; Sec. 3. Dioptrics, or Refraction at Regular Surfaces; Sec. 4. Chromatics; Sec. 5. Vision; Sec. 6. Optical Instruments; Sec. 7. Physical Optics. CHAPTER II.—HEAT—Sec. 1. Nature of Heat; Sec. 2. Measurement of Temperature; Sec. 3. Expansion; Sec. 4. Communication of Heat; Sec. 5, Action of different Bodies upon Heat; Sec. 6. Calorimetry; Sec. 7. Liquefaction and Solidification; Sec. 8. Vaporization and Condensation; Sec. 9. Spheroidal condition of Liquids; Sec. 10. The Steam Engine; Sec. 11. Ventilation and Warming; Sec. 12. Sources of Heat; Sec. 13. Correllation of Physical Forces. CHAPTER III.—ELECTRICITY—Sec. 1. Magnetic Electricity; Sec. 2. Statical or Frictional Electricity; Sec. 3. Dynamical Electricity; Sec. 4. Electro Dynamics; Sec. 5. Electro Dynamic Induction; Sec. 6. Other Sources of Electrical Excitement.

APPENDIX.

CHAPTER I.—METEOROLOGY — Sec. 1. Climatology; Sec. 2. Ærial Phenomena; Sec. 3. Aqueous Phenomena; Sec. 4. Electrical Phenomena. Addenda.

STATISTICAL.

Emigration from the United Kingdom.

In the 45 years from 1815 to 1859 inclusive, there left the United Kingdom 4,917,598 emigrants. In the 32 years between 1st January 1815 and 31st December 1846 the emigration amounted to 1,672,156, or an average of 52,254 souls a year. In 4 years only (1832, 1841, 1842, and 1846) did the numbers exceed 100,000.

In 1847 the numbers suddenly sprung up to 258,270; nearly double the number of the previous year, which had been the largest emigration up to that time. They continued to increase, with unimportant variations, till 1852, when the emigration reached its maximum of 368,764. Between 1st January 1847 and 31st December, 1854 the number of emigrants who left the United Kingdom amounted to 2,444,802, equal to 305,600 a year.

After 1854 the emigration declined as rapidly as it had grown, amounting in that and the three subsequent years to only 680,208 souls, or on an average 170,052 souls a year. In 1858 it fell still lower, amounting to only 113,972; in 1859 it amounted to 120,432 souls.

The causes of this sudden decrease are not far to seek. They are to be found in the increased demand for young men in the army and navy, and the departments connected with them, arising first from the Russian war and afterwards from the Indian mutiny—the rapid improvement in Ireland—and the ample employment now offered in this country for almost every description of labour. Add to this that the years 1857 and 1858 were years of embarrassment and distress on the North American continent, which had not altogether passed away in 1859. The inducement to emigration ceased, therefore, on the other side of the Atlantic at the same time that the inducement to remain became strongest on this.

When emigration was at its highest the great majority of the emigrants were Irish. After 1851 the proportion of Irish began to decrease, and the diminution was continuous and gradual, till in 1858 they formed only 38 per cent. of the whole emigration. In 1859 their proportion was 43·95. The decrease was the natural result of the improvement of the country. That it did not arise from want of funds to emigrate, is evident from the large sums of money still remitted to Ireland by those who have gone to America and Australia.

Returns showing the Amounts of Money remitted by Settlers in North America to their Friends in the United Kingdom from 1848 (the first Year in which we have any Information) to 1859, both inclusive.

YEAR.	AMOUNT.
1848	£460,000
1849	540,000
1850	957,000
1851	990,000
1852	1,404,000
1853	1,439,000
1854	1,730,000
1855	873,000
1856	951,000
1857	593,165
1858	472,610
1859	*621,176

Manufacture of Clocks in Connecticut by Machinery.

In Connecticut there are seven manufactories, employing 1,300 persons, and producing annually 800,000 wooden clocks; in Bristol, 14 manufactories with 400 persons, making 200,000 clocks; Plymouth has three manufactories, with 175 workmen, turning out 75,000 clocks; at Ausonio are two manufactories, with 140 persons employed, who make annually 102,000 clocks; at Winshotrad, one manufactory, with 40 persons, 30,000 clocks; at Southampton, two manufactories, with 45 workmen, producing 40,000 clocks, and, lastly, at Newhaven there are three manufactories employing 400 persons, and making 370,000 clocks, so that in the seven above-mentioned places, there are 32 manufactories, employing 2,500 workmen, and producing 1,617,000 wooden clocks.

The frames of the clocks are stamped out of sheet brass, and all the holes are punched simultaneously by a series of punches fixed at the required distances. The wheels also are stamped out of sheet brass, and a round bedding is raised by a press round their rims, for the purpose of giving them lateral strength. They are cut by a machine having three horizontal axes, carrying each a cutter placed about four inches apart. The first cutter is simply a saw, and the second rounds off the teeth. In cutting an escapement wheel, the first cutter is made to cut each tooth entirely round, and then either the second or third axis with its cutter is used for finishing. The pulleys on the three axes are driven by one driving pulley with three straps working over and in contact with each other. The plates forming the clock faces, and other discs, are cut by circular shears. The beaded rims intended to go round the clock faces, varying in size from fifteen inches downwards, are stamped in concentric rings out of a disc, and then made of the required form by means of dies and a stamping press. The ogee form given to the wooden framing of the common clock, is formed by a revolving cutter of the required shape, making 7,000 revolutions per minute, over which the piece of wood is passed by hand—the requisite pressure downwards being given at the same time. Each clock passes through about sixty different hands; more than one half of the clocks manufactured are exported to England, and of these a large portion are re-exported to other markets."

The Sewing Machine.

According to certain detailed computations, it is shown that the value of the sewing in the United States capable of being done by the sewing machines is as least £58,000,000 per annum, and that Howe's machine, even if applied to the work in the exact form in which he first introduced it, would save to the public £34,000,000 per annum. Looking only at the actual results achieved, the sewing machine has already entered into and revolutionized more than 37 distinct departments of manufacture, besides enlarging many and also creating new ones. In the city of New York alone the yearly saving by the machine is asserted to be $7,500,000 on men's and boys' clothing, $360,000 on hats and caps, and $850,000 on shirt fronts; while in Massachusetts, in the manufacture only of boots and shoes, the labour value of its performance is $7,500,000

* £45,798 of this sum remitted from Australia.

NEW INDUSTRIAL PROCESSES.

New Method of Extracting the Perfume of Flowers.

A new and interesting process is that patented by M. Millon, a French chemist, for extracting the aroma of flowers by means of ether, or sulphuret of carbon, which are both powerful solvents. M. Millon operates in this way:—The flowers are placed in a percolating apparatus, and the ether or sulphuret of carbon poured over them; after leaving them in contact for ten or fifteen minutes the liquid is drawn of, and a fresh quantity added, and drawn off in the same way. This completely dissolves all the odour of the flowers, and leaves them quite scentless. The liquid is then distilled, and the ether or sulphuret of carbon becoming volatilised at a much lower temperature than the fragrant principle, is drawn over alone, and leaves a residue containing all the perfume of the flower. This residue is sometimes quite solid, and sometimes semi-liquid, but it always becomes solid in a short time. It is spread in thin layers, and exposed to the heat of the sun, or some equivalent temperature, until it loses the unpleasant smell of the solvent used. It can be left open for any length of time without evaporating, nor is any degree of natural heat capable of altering the perfume or turning it rancid. It has a much finer flavour than any sort of essential oil, which M. Millon explains by stating that the perfume of a flower always became altered by being subjected to a higher temperature than that of the atmosphere If this residue is treated with alcohol it takes up the odour and colouring matter, and a small portion only of the resinous and waxy matters forming the residue. This alcoholate again treated with distilled water gives up the greatest part of the aroma. Plain water, however has no effect on it. The residue is also soluble in grease or oil. This process is very curious in a scientific point of view, as it is the nearest approach that has been made yet to the insulation of perfume from the substances into which it is usually embodied. It is far from being, however, the actual fragrant principle in a solid and palpable shape, nor has Mr. Millon been able to ascertain exactly what proportion it bears to the flowers used. The residue he obtains averages from one to three grammes per kilogramme (or one to three per 1,000) and when it has been treated with alcohol, and given up all its perfume and coloring matter, the inodorous waxy substance left seems to have lost scarcely a few hundred parts of its weight. M. Millon tried to isolate the aroma from alcohol by distillation, but it became lost in the operation, and on his trying to evaporate it with distilled water the water became perfumed, but without leaving the fragrant principle floating on the surface, as is generally the case. He found it therefore, theoretically and practically impossible to solve that interesting question. This process has not yet received any application on a large scale.—*Journal of the Society of Arts.*

On the Preservation of Flesh, by Verdeil.

Having been separated from the bones, and, as far as possible, from fat, the flesh is cut into slices from one to five centimetres (one centimetre = 0·3937 inch) in thickness; the slices being cut as nearly as possible

across the grain of the flesh. These are now laid upon hurdles of basket-work, which are subsequently placed in a chamber. As soon as a sufficient number of the trays have been introduced into the chamber, it is closed, and steam under a pressure of three or four atmospheres consequently of 135° to 142° C. [= 273° to 293° F.] is admitted through several openings.

The chamber which may be of lead or iron, must not be absolutely tight, and a small outlet for the steam being necessary, in order that the pressure may not become too great.

After from six to ten or fifteen minutes according to the kind of flesh and the thickness of the slices, the steam is shut off, this part of the process being finished.

The flesh is now very nearly in the condition of boiled meat, but has retained all of its ingredients, the albumen having been coagulated; its taste recalling that of roasted meat. It presents a wrinkled appearance, is of a grey color, and may be readily divided.

Being removed from the steam chamber, the flesh is now placed upon trays, or hung upon hooks, in another chamber, which is warmed, but in which the temperature is never allowed to exceed 40° or 50° C. [= 104° to 122° F.] The drying process is completed in the course of eight or twelve hours.

Packed in tight casks or in tin boxes, so that it may be protected from the action of moisture, and from insects, the flesh thus prepared may be preserved for any length of time which may be desirable. It is nevertheless well to place a layer of salt in the casks, in order that it shall absorb any moisture which the flesh may have retained. Before using this meat it must be soaked for an hour or two in warm water in which it softens and regains its original condition. When boiled with water it affords an excellent soup and passes into a condition in which it cannot be distinguished from fresh meat.—*Le Génie industrial, Boettgir's polytechnisches Notizblatt*, xv. 71.

Electro-Zincing by MM. Person and Sire.

In a hundred parts of water dissolve ten parts of alum, and one of oxide of zinc; this zinc-bath should be kept at a temperature of 15° C. The pieces of metal which are required to be coated with zinc being previously well cleaned, are arranged so as to form the negative pole of a battery, and for the positive pole one or more pieces of zinc are introduced, according to the shape of the articles to be zinced, and having as near as possible the same amount of surface. Contact with the battery being made, by the current from one pair of plates, the dimensions of which should vary according to the surface to be coated, the precipitation of zinc proceeds as easily as that of copper in the ordinary electrotypic process, the deposit taking place indifferently on any metal, on platinum as well as on copper or iron. When copper, coated with zinc, is heated, there is produced a coating of brass; this transformation is likely to receive many applications. The elevation of temperature of the zinced iron augments the adhesion of the surface of zinc. MM. Person and Sire state that the thickness of the layer which is deposited increases in proportion to the time occupied in the deposition; that the reduced zinc has all the properties of the purest metal; and that it completely prevents the oxydation of the object which it coats.

Bitumenised Paper Tubing.

An experiment was made in the Spring of the present year under the Great Clock Tower, Westminster, for trying the strength, by Hydraulic pressure, of a new description of tubing, composed of bitumenised paper, invented by M. Jaloureau of Paris. M. Jaloureau is a contractor for paving Paris, and other towns in France with bitumenous concrete. It happened in the course of his experiments, that some paper which had been coated with bitumen was laid aside in a coiled form, and after some time it became very stiff and solid. Pursuing the idea which thus accidentally occurred to him, M. Jaloureau put several layers of bitumenised paper round a cylinder, and submitting them to internal pressure, he found that a tube a quarter of an inch in thickness was capable of resisting a pressure of 250 lbs. to the square inch. The municipal authorities of Paris tried these tubes for the conveyance of gas, and in the recent experiments made here a piece of tube was produced, which, though stated to have been under ground in Paris as a gas pipe for twelve months, had the appearance of being a new pipe. The tubes subjected to the pressure of the hydraulic pump, bore a strain of 250 lbs. to the square inch without bursting, which is more than they would be ever called on to bear in ordinary use. One of the tubes, half an inch thick, and with a bore of two inches, was also tested by weight, and it only gave way to a pressure of 428 lbs., the bearings being three feet apart. It was stated that the tubes might be submitted to a temperature of 160 degrees of Fahrenheit without any deterioration of the material. The cost of the tubing is said to be less than half that of the ordinary iron piping.

Cheap and Expeditious Method of Preserving Timber.

The method pursued at Closeburn, by the late Sir Charles G. S. Menteith, in preparing wood for the purposes of building, was to saw it into such lengths at the occasion demands; next, to plunge the planks or beams into a pond, of suitable dimensions, having the bottom and sides rendered water-tight. Before receiving the wood, a quantity of fresh-burned lime was thrown into the pond and well-stirred with the water, to dissolve as much as possible of it. Into this strongly-impregnated solution of lime-water the planks or beams were then thrown. As lime-water absorbs carbonic acid from the air, the lime previously held dissolved in the water becomes insoluble and falls to the bottom, and becomes carbonate of lime. Hence the necessity of now and then throwing in fresh portions of recently-calcined lime, that the solution may maintain its strength.

With respect to the time that it is necessary to soak the wood in lime-water, it must depend very mnch upon the thickness and texture of the wood; roofing timber of fir will require at least a fortnight; larger and closer grained wood, as oak and other ship timber, ought to be steeped for three or four weeks, or even a longer time.

After removing the wood from the lime-water pond, it must be allowed to dry and season before it is used.

Among the benefits that this preparation of wood by the late Sir C. G. S. Menteith presents, we may safely enumerate the following, viz:—

1. The lime which is absorbed by the pores of the wood appears to alter or destroy the albuminous and saccharine principles, and, destroying the food of the worm, saves the wood from its ravages.

2. The last elements, the albumen and sugar, having been so acted upon by the lime, there is less apprehension of the wood being infected by the dry rot.

3. The wood soaked in lime water becomes firmer in texture and more durable. It is the well-known property of waters holding lime in solution, called "petrifying wells," to penetrate and deposit upon all substances exposed to their influence small crystals of carbonate of lime. When wood is plunged for some time in a strong lime-water solution, a slight petrifaction of the wood is observable. The carpenter who has to work up the wood taken out of the lime-water pond, complains grievously that the edge of his plane is constantly blunted, and re-

quires to be again and again sharpened. This arises from the small crystals of carbonate of lime covering the surface of the wood, and also from their having insinuated themselves into the pores of the wood; the plane coming in contact with these has its edge taken off. Were the wood, prior to being put into the pond, smoothed with the plane, this objection of the carpenter would be prevented.

Photography—The "Instantaneous Process."

"It is always desirable that the photographer should have at his command the means to take that limited class of pictures or views in which there are moving objects—such as street views, vessels in motion, &c. For this object, different methods, called 'instantaneous processes,' have been devised. The following is one that has never been published, and gives very good results:—The first thing to be done is to make a very sensitive alcoholic collodion, as follows:—To 4 fluid ounces of sulphuric ether (sp. gr. ·720), add 4 fluid ounces of 95 per cent alcohol; in this, dissolve 140 grains of soluble cotton made in rather weak acids, so that it has a short structure, and, when all dissolved, add 12 fluid ounces more of alcohol which finishes the plain collodion. To 20 ounces of this collodion, add 2 fluid drachms of a saturated solution in water of iodide of potash and 30 grains of bromide of cadmium: allow the undissolved particles held in suspension to subside, and the collodion is complete. Use a neutral 45-grain nitrate of silver bath; develop with water, 16 ounces; protosulphate of iron, 1 ounce; acetic acid (No. 8) 1 ounce; alcohol, 1 ounce. Fix the picture, as usually done, with cyanide of potassium. When the picture has been thus far complete, it lacks the required degree of intensity for a negative, and the following method is resorted to for this object:—After it has been fixed and well-washed, pour over the plate a saturated solution of bi-chloride of mercury, after which wash the plate well; then pour over it some water in which 2 or 3 grains of iodide of potassium or iodide of ammonium, (which is the best) have been added to the ounce, when the plate is to be again well-washed. If the intensity is not sufficient, this process is repeated until the required intensity is obtained."—(*Humphrey's Journal of Photography*, by L. M. Dornach.)

MISCELLANEOUS.

Proposed Private Telegraph Extension.

The establishment of private telegraph wires in the United Kingdom is rapidly rising in public estimation. In order to obtain privacy of information and almost instantaneous communication between public or private offices, the Universal Private Telegraph Company has been instituted in London.

Instead of having wires as in ordinary cases, they suspend from posts a rope containing a multitude of wires—perhaps thirty, or, if that is not enough, forty or fifty, or more. One feature of such a plan is, that all parties can have a telegraphic communication at a very reasonable rate. The expense of erecting telegraphs according to the patent system, is about £65 per mile; but by the plan proposed by the new company, of multitudinous wires, parties were enabled to rent a wire at a sum of £4 per mile per annum. Therefore, merchants residing, one, two, or three miles from their places of business, or having places of business so far apart, can have private communication at either £4, £8 or £12 per annum. Another great feature connected with the establishment of this company is this, the apparatus is so simple, that parties require no instruction in the use of it. To send a message it is only necessary to press the key opposite any of the letters of the ordinary English alphabet, which are marked on the index, and by turning a little handle the message is immediately transmitted to a corresponding instrument at the other end. Another thing connected with the instrument is the total absence of battery power, the current being produced by turning a piece of soft iron near a magnet. The power being so generated, and the magnet not being liable to deteriorate, the instrument is at all times in perfect order. People might leave their houses for six months, and when they went back they would find it in order.

In Manchester, Mr. W. Fairbairn, the eminent engineer, had consented to carry out the principles of the company, and Professor Wheatstone had undertaken the management in London. Mr. Reuter also intended to have wires erected between his office in the Exchange and all the principal newspaper offices in London; and it was also contemplated to lay wires from the Houses of Parliament to the several newspaper offices in the same way. In London all the stations were being connected, and lines of communication were being extended in every conceivable direction. In Glasgow many of the leading firms had already consented to co-operate with the police, and no fewer than twenty-three of these firms had become shareholders in the company, not only because they approved of the system, but also on public grounds, that there might be no doubt of its being carried out.

Lighting Picture Galleries by Gas.

The Commission consisting of Professors Faraday, Hoffman, and Tyndall, Mr. R. Redgrave, R.A. and Captain Fowke, R E., appointed for the purpose of reporting to the Lords of the Committee of Privy Council on Education *On the Lighting of Picture Galleries by Gas, and on any precautions (if necessary) against the escape of Gas, and the products of its combustion, report as follows:*—

There is nothing in coal gas which renders its application to the illumination of Picture Galleries objectionable. its light, though not so white as that of the sun, is equally harmless; its radiant heat may be rendered innocuous by placing a sufficient distance between the gas jets and the pictures, while the heat of combustion may be rendered eminently serviceable in promoting ventilation.

Coal gas may be free from sulphuretted hydrogen compounds, and in London is so at the present time; it then has little or no direct action on pictures. But it has not as yet been cleansed from sulphide of carbon, which, on combustion, yields sulphurous acid gas capable of producing 22½ grains of sulphuric acid per 100 cubic feet of present London coal gas.* It is not safe to permit this product of the combustion to come in contact with pictures painted either in oil or water colours; and the Commission are emphatically of opinion that in every system of permanent gas lighting for Picture or Sculpture galleries, provision should be made for the effectual exclusion or withdrawal of the products of combustion from the chambers containing the Works of Art.

The Commission have examined the Sheepshanks' Gallery as an experimental attempt to light pictures with gas, and are of opinion that the process there carried out fulfils the conditions of effectually illuminating the pictures, and at the same time removing the products of combustion. According to the indications of the thermometer required and obtained, it does this in harmony with and in aid of the ventilation, and does not make a difference of more than one degree Fahrenheit at the parts where the pictures are placed between the temperatures before and after the gas is lighted.

* Hoffman.

Glasgow Athenæum.

At the public opening of the class session of the Glasgow Athenæum, Oct. 18th, Sheriff Strathern delivered an able address on the advantages which the Athenæum placed within reach of the industrial classes, and on the success of Scottish students in competing for the certificates and prizes of the Society of Arts.—Subjoined is an abstract of the address :—

Sheriff Strathern said the effect of the ever progressive condition of the country had been to drag education along with it; and the state of society would have been singular if improvement in education had not been conspicious as in any other human pursuit. It was satisfactory to know, that the progress of recent legislation had rendered it in a great degree compulsory on workmen in more than one industrial calling, to acquire some learning by making it the condition of employment. But if there was one circumstance more remarkable than another in showing what he now advanced, it was the pleasing and most important one, that from the labouring classes, places of trust, of management, of superintendence—requiring intelligence, integrity, and education—are being filled. Our public works and factories would furnish abundant evidence of the fact, and the growing thirst among the working classes for education and information still further attested it. The advent of cheap literature, about 25 years ago, might have paved the way for this desirable consummation, but he was persuaded its realisation had been mainly attributable to the establishment of mechanics' and other similar institutes throughout the country. Nor did this important phase in the character of the working population stand alone. Among the industrious of the middle ranks has a similar transitional improvement been noted. The youth of the country, destined for commercial life, had been stimulated to stretch beyond the acquisition of mere rudimentary mercantile rules, and sought a higher and still more intellectual flight in the prosecution of their stndies. The Metropolitan Society of Arts has done much, especially of late years, to encourage and foster this turn in commercial training, but the immediate cause he believed to be the facilities furnished by the numerous educational establishments and societies with which our large cities abounded. The reports of the past year showed the continuing usefulness of the Athenæum; its annual meetings had been honoured and dignified by the eminent and influential of the city; and the noble and great of the land had been numbered among the lecturers. It was one of the very few institutions in Scotland which formed an alliance with the Society of Arts of London. From that connection much good had already arisen, and the programme for the present session, containing also the results of the last, left no room to doubt the permanency of its benefits. The system of examinations prescribed guarranteed the value of its training; no student could pass if he was superficially taught, and the number who had achieved distinction during the past session incontestibly established the solid character of the tuition and the skill of the teachers. The competitive plan for stimulating study had been most successfully followed by the Society of Arts, and the prizes and certificates which it distributed were not earned by the slothful or careless. Such testimonials were the honourable tributes to assiduous study, and could be purchased by that toil which alone could bring knowledge. These consideratious gave worth to such certificates, intrinsically, for to a dunce they had no value,—but to the industrious and zealous such certificates were above estimate. The success of the Athenæum in the last session had been very marked indeed, the success of the Scotch students generally had been very great. About 500 certificates in all had been awarded to students in England, Ireland, and Scotland. Of these, 110 had been assigned to Scotch, and the remainder to English and Irish students.

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure; but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation, by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Mechanics' Institute Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

The present issue of this Journal is Two Thousand Copies, and in order that future issues may be as large as is consistent with the duties of the Board of Arts and Manufactures for Upper Canada, it is desirable that Mechanics' Institutes should communicate to the Secretary of the Board the number of copies they are willing to take, with the least possible delay. The attention of Inventors and Patentees is also called to the advantage of communicating at an early date; and the Publishers to whom this Journal may be sent are requested to intimate whether they will be prepared to furnish, from time to time, works for review, of the class likely to meet with favor among the members of Mechanics' Institutes.

THE JOURNAL
OF THE
Board of Arts and Manufactures,
FOR UPPER CANADA.

FEBRUARY, 1861.

THE PETROLEUM, OR ROCK OIL OF CANADA.

For many years the Petroleum found floating on the surface of the Thames and Sydenham rivers, in the western part of the province, attracted some degree of attention, but it was not until the "rock oil" of Western Pennsylvania proved to be both abundant and of considerable commercial value that practical men directed their capital and industry to the so-called "oil springs" of Upper Canada. Now that public attention has been repeatedly called to the existence of these springs, and some of them have already acquired a certain degree of importance, as supplying material for a growing industry, it is time to enquire into the prospects which this new source of wealth offers to capital and enterprise, and how far we may suppose it susceptible of profitable extension.

In the first place, it is necessary to enquire into the source of supply and endeavour to ascertain its probable limits. This can best be done by examining into the origin of the petroleum or rock oil, and tracing the limits of those geological formations from which it is supposed to proceed.

There are two classes of bituminous substances which exist as natural deposits or exudations, and are often misnamed in popular descriptions. Some of these bodies are the probable result of the union of others with oxygen, derived from air or other sources.

They may be divided as follows:

1. Petroleums, or rock oils, or naphthas.
2. Bitumens or asphalts.

The members of the first class consist of two elements only, namely, carbon and hydrogen.

Those of the second class consist of carbon, hydrogen and oxygen.

Petroleum and others of its class result from the decomposition of organic substances of animal or vegetable origin, under a moderate temperature and pressure, in the absence of oxygen. Bitumens are probably the result of the oxydation of petroleums, and their hardness depends to a certain extent upon the amount of oxygen they contain.

All, or most true bitumens melt in boiling water; when they require a more elevated temperature to soften or liquify them, they receive the name of asphalts.

Bitumens and petroleums are found in all parts of the world, and in many countries have long been employed for economical purposes. In the United States, where rock oils have suddenly acquired great prominence, very extensive sources of supply exist.

On the Alleghany river, in the neighbourhood of Pittsburgh, a spring of petroleum was struck in boring for salt, which has been known to yield eighteen hundred barrels a day at one place only. In Kentucky, petroleum springs are not at all uncommon. In that part of Pennsylvania and New York which borders on Lake Erie, and in the north eastern part of Ohio, the rock from which the petroleum issues belongs to the Upper Devonian series. In other parts of Pennsylvania, in Ohio and Virginia, petroleum is found associated with the Carboniferous rocks, and probably proceeds from certain members of the series. It is in Western Pennsylvania that petroleum springs are at present most numerous and important. In the counties of Venango, Mercer and Warren, a new branch of industry is rapidly growing into great importance, and is in fact effecting a very beneficial influence upon the population and wealth of that part of Pennsylvania. The collateral branches of industry to which the preparation of the crude oil gives rise, are very valuable in themselves; and if the supply continues to keep pace with the appliances introduced to secure the raw material, it is not easy to estimate the value of the "oil region" of Pennsylvania, Ohio, Michigan, and south eastern New York.

The rock formation from which the petroleum of the north western part of Pennsylvania and the south-western counties of New York exudes, is probably that member of the Upper Devonian series which the New York geologists have denominated the Portage and Chemung Group. This group of rocks is of immense thickness in the United States, and is developed to a very great extent in Western Pennsylvania and in the State of Michigan. It is the Vergent Series of Rogers, the able State Geologist of Pennsylvania, and is supposed to be not less than 4,900 feet thick. It is the next group but one underlying the Coal series; and between it and the lowest member of the Carboniferous rocks there is interposed the Catskill Red Sandstone, the Ponent Red Sandstone of Rogers, which has a supposed thickness of 5000 feet. Twenty years ago, James Hall, the distinguished U. S. Geologist, described the Petroleum Springs in Chautaque County, N. Y., bordering Lake Erie, as exuding from rocks belonging to the Portage Group. Carbonaceous matter frequently occurs in their strata, and much money and time has been expended in the United States in an expensive and wholly fruitless search for coal, by persons who have been misled by the thin laminæ of bituminous matter which is

often met with in these Devonian rocks, and also in that member of the lower Silurian series in Canada which bears the name of the UTICA SLATES, and which is used at Collingwood for the distillation of "Shale Oil." The idea that the petroleum or rock oil of South Western New York, North Western Pennsylvania or Canada is necessarily associated with the coal bearing rocks, is altogether erroneous; and an attempt to search for coal from the supposed indications offered by "coal oil," or petroleum, would be wholly fruitless as regards coal itself, in many places where the oil is most abundant. Even if the Catskill Red Sandstone should be altogether wanting, there are conglomerates and carboniferous limestones lying above the Catskill Sandstone, before the coal measures begin, and these have a united thickness in the States of 5,600 feet, and are found in Michigan, together with the PORTAGE and CHEMUNG GROUP, underlying the coal field of that State.

The PORTAGE and CHEMUNG GROUP occupy nearly the whole of the south shore of Lake Erie, and extend far inland into the States of Pennsylvania, New York and Michigan. Many rock oil springs are found on or near the edges of the great Pennsylvanian coal field, where it overlaps the Portage and Chemung groups below it. There is no reason to doubt that they will ultimately be touched by the borer in many parts of the vast area of *western* country occupied by the Portage and Chemung group; but it must be borne in mind, that an inspection of a geological map is not a sure guide to the prospecter for coal oil. Rocks of the same geological age vary immensely in their mineral characteristics, and it is a remarkable case in point, that the same group of rocks which in the Western part of New York show such abundance of petroleum, in the eastern counties are altogether free from it.

It is necessary to be thus particular with respect to the geological position of the rock which forms the source of the petroleum; for as we have no trace of the Carboniferous Series remaining in Western Canada, we must search for the origin of the petroleum in that group of rocks which is known to yield it in abundance, and which is represented to a small extent in the most western counties of Upper Canada.

The Portage and Chemung groups extend from Michigan into Canada, entering the province near Kettle Point, Lake Huron, where the lowest members of this important group are exposed. They are there seen underlaid by limestone belonging to the Hamilton group, the series beneath them. The highly bituminous shales of the Portage and Chemung groups are also exposed on Bear Creek, in the township of Warwick, and in the township of Brooke. Petroleum springs, which doubtless come from this formation, are found in the townships of Enniskillen, and also in Mosa.

The reason why the Portage rocks of Michigan are not continuous with those of Pennsylvania, but are separated by a belt of the underlying Hamilton formation, has been very clearly shown by Sir Wm. Logan, in an article "On the Physical Structure of the Western District of Upper Canada," published in the *Canadian Journal* for August, 1854.

The area covered by the Portage rocks in Western Canada is very limited, when comparisons are made between their extensions in Pennsylvania and Michigan, where they occupy a region probably exceeding the whole of the settled parts of Upper Canada. Mr. Murray, of the Canadian Geological Survey, states that the Portage rocks in the western counties probably consist of two outlying patches, separated from one another by the Hamilton shales in the township of Euphemia. If this be the case, we shall have two rock oil or petroleum fields in Canada, in which that substance may be searched for by boring with considerable chance of success. These are the western field, including the townships of Plympton, Warwick, Brooke, Enniskillen, and perhaps Moore and Sarnia. The eastern field will be roughly shown by the townships of Camden, Zone and Mosa; but in so level a tract of country, it is very probable that those portions of the Portage and Chemung groups which have escaped denudation will be found over wider though perhaps more detached areas than is represented above.

Several important conclusions of a practical value may be derived from a knowledge of the extent of surface occupied by the rocks known to yield petroleum in Western Canada. The first is, that their thickness must be so small as to obviate the necessity of deep boring. If the borer passes through the Portage group without finding petroleum, and comes upon the underlying Hamilton shales, the operation should be pursued with extreme caution; for although petroleum is by no means uncommon in the bituminous shales of the Hamilton group, yet as these rocks have been bored in *search for coal* from one end of the State of New York to the other, at vast expense, without reaching rich petroleum springs, it cannot be regarded as a fruitful source of that material. Secondly, the supply of petroleum is likely to be soon exhausted in particular wells, until, by slow infiltration from higher to lower levels, the spring is replenished. Thirdly, the nature of the rock, which in some of its layers is compact, holding globules or drops of petroleum between the laminæ, will allow a copious spring to be struck in one locality, and yet within a few yards all attempts may be ineffectual. Fourthly, deep boring is to be avoided in the western counties. It will probably be very successful on the Michigan

coast of Lake Huron, commencing a few miles above the mouth of the St. Clair, and extending fully 20 miles inland. It may also be successful on nearly the whole of the south shore of Lake Erie, but in Canada shallow borings will be likely to give favorable results only, within the limits indicated in the preceding paragraph.

With respect to the supply which may be looked for in our Canadian rocks, if the Hamilton Shales do not yield it, it may be stated with a considerable degree of confidence that the quantity will be very small compared with the abundant store in the United States. It will probably be also intermittent, and springs which promise favourably for a time will soon be exhausted, and require a greater or less period for their restoration. This will appear at once from the limited area occupied by those rocks from which the petroleum proceeds. They are merely outlying patches of the great Pennsylvanian and Michigan fields which underlie, with their associated formations, the coal measures of those States. At the best, the western patch in Plympton, Warwick, Brooke, &c., is but a tongue of the Michigan field; and possessing but a limited area, it has also a very small thickness, probably not exceeding one hundred feet. Hence, it is not likely that Canadian rocks can contain a large supply of this important material. But while we would strongly caution "prospecters" against deep boring, yet there is no reason why numerous shallow wells should not yield a considerable supply for some time to come—quite sufficient to make a limited outlay of capital, cautiously expended, give remunerative results; but it does not appear probable that the supply will be found sufficient to create a lasting and increasing industry. The deposits of asphaltum or bitumen in the township of Enniskillen are perhaps the existing records of petroleum springs which have been oozing for ages, and the material, by long exposure to the atmosphere, has absorbed oxygen and become converted into the viscid or semi-solid mass which now occupies several shallow depressions in that township, and also in Zone. Wherever these deposits are found, it appears reasonable to suppose that boring would reveal a petroleum spring, and in such localities a search for the fluid would be most successful and the supply most abundant.

THE SOLID MATERIALS CONVEYED TO THE SEA BY THE OTTAWA AND ST. LAWRENCE.

Few but those who have given attention to the solvent powers of water, can form an adequate conception of the enormous quantities of mineral substances annually conveyed to the sea by our great rivers. The amount of lime, flint, glaubers' salt, magnesia, soda, &c., dissolved out of the rocks over which the Ottawa and its tributaries flow, reaches the astonishing quantity of five million one hundred and fourteen thousand tons annually, most, or all of which, is carried to the sea. The quantity dissolved and carried away by the St. Lawrence, is not only vastly greater, on account of the magnitude of the river, but also because the St. Lawrence holds a much larger quantity of mineral substances in solution than the Ottawa. In every 10,000 lbs. weight of the Ottawa water, there are $9\frac{78}{100}$ ounces *avoirdupois* of solid matter. In 10,000 of the St. Lawrence water, there are $1\frac{6}{10}$ lbs. *avoirdupois* of mineral substances. These differences in the volume of water and amount of mineral substances held in solution, cause the St. Lawrence to carry towards the sea, not less than one hundred and forty-three million tons of minerals per annum. These estimates are based on the suppositions that the volume of water in the Ottawa is represented by 85,000 cubic feet flowing past a given point (Grenville) in one second of time,* and that the mineral substances it holds in solution are 6116 lbs. in 100,000,000 lbs. (0.6116 in 10,000.)† The volume of water in the St. Lawrence is represented by 900,000 cubic feet‡ in a second of time flowing past a certain point, containing 16,055 lbs of mineral substances in 100,000,000 of water. (1.6055 in 10,000 parts.)||

The following analyses by Mr. Hunt, show the relative quantities and kind of minerals in the respective waters of the two rivers, in 10,000 parts.

OTTAWA WATER.

Carbonate of Lime	0.2480
" Magnesia	.0696
Silica	.2060
Chloride of Potassium	.0160
Sulphate of Potash	.0122
" Soda	.0188
Carbonate of Soda	.0410
Alumina and oxide of Iron. (traces.)	
Manganese and Phosphorus "	
	0.6116

ST. LAWRENCE WATER.

Carbonate of Lime	0.8083
" Magnesia	.2537
Silica	.3700
Chloride of Potassium	.0220
" Sodium	.0225
Sulphate of Soda	.1229
Carbonate of Soda	.0061
Alumina, Phosphoric Acid. (traces).	
Oxides of Iron and Manganese "	
	1.6055

A cubic foot of water at the temperature of 60° Fah., weighs 998,217 oz., *avoirdupois*, or 62,3885 lbs.

* Thos. C. Clarke, C. E., Ottawa Survey.
† T. Sterry Hunt, F. G. S., Geological Reports, 1853.
‡ T. C. Clarke, C. E.
|| T. Sterry Hunt, F. G. S., Geo. Reports, 1853.

A series of simple calculations will show that in accordance with the foregoing data, 5,303,022 lbs of water pass Grenville, on the Ottawa, in one second of time. This immense mass of liquid carries with it 131.515 lbs of Carbonate of Lime or chalk; 36.9 lbs of Carbonate of Magnesia; 109.21lbs of Silica, or flint; 8.484 lbs of Chloride of Potassium; 6.47 lbs of Sulphate of Potassa; 9.969 lbs of Glaubers' Salts; and 21.742 lbs. of Carbonate of Soda; in all 324½ lbs nearly, of mineral substances every second of time, or more than five million tons in a year. By the same process we arrive at the curious and instructive result, that the St. Lawrence is the bearer of more than one hundred and forty-three million tons per annum to that great depository, the sea. Suppose this operation to continue for many thousands, and even hundreds of thousands of years, it can be easily understood how, by this slow but sure process, deep lake basins and river valleys are dissolved away and conveyed to the ocean, to form new rocks over its floor, and afford building materials for the countless millions of animals and vegetables which people its depths. A very considerable quantity of the materials thus carried away, would be deposited as soon as they reached salt water, in consequence of the large quantity of substances already in a state of solution in sea water; water possessing the curious property of relinquishing a certain proportion of minerals already in solution upon the addition of a fresh supply of a different substance. Thus, if water is saturated with common salt, that is to say contains as much common salt as it can hold in solution, and a portion of magnesia be added, the water will relinquish a definite quantity of salt, and take up a little magnesia; if now some potash be added, a small proportion of salt and a small quantity of the dissolved magnesia will be precipitated, and a corresponding quantity of potash dissolved; so also with regard to each new soluble mineral introduced, the water will always make room as it were for a certain proportion by relinquishing a little of each of the other minerals dissolved. Hence when the waters of the St. Lawrence mingle with the salt ocean, a part of their constituents will remain dissolved, and a part be precipitated, together with small quantities of the other compounds held in a state of solution by sea water. By this process, independently of animal or vegetable organisms, and the deposition of mechanically suspended matter, the floor of the ocean is gradually being covered with fine mud, which in process of time will become consolidated, entombing within it the remains of those marine animals and plants which derive the materials for the construction of their shells, shields, and the hard parts of their tissue from the dissolved constituents of sea water. In the foregoing remarks no reference has been made to the organic matter contained in the waters of the Ottawa and St. Lawrence. In those of the former river the amount is considerable, and gives a perceptible pale amber yellow colour to it; those of the latter are clear and transparent, containing but a small proportion of organic matter either in suspension or solution.

Mr. Hunt thus compares the waters of the Ottawa and the St. Lawrence.*

"The comparison of the water of these two rivers shows the following differences:—The water of the Ottawa, containing but little more than one-third as much solid matter as the St. Lawrence, is impregnated with a much larger portion of organic matter derived from the decomposition of vegetable remains, and a large amount of alkalies uncombined with chlorine or sulphuric acid. Of the alkalies determined as chlorids, the chlorid of potassium in the Ottawa water forms 32 per cent. and that of the St. Lawrence only 16 per cent., while in the former the silica equals 34 per cent., and in the latter 23 per cent. of the mineral matters. The Ottawa drains a region of crystalline rocks, and receives from these by far the greater part of its waters; hence the salts of potash liberated by the decomposition of these rocks are in large proportion. The extensive vegetable decomposition, evidenced by the organic matters dissolved in the water, will also have contributed a portion of potash. It will be recollected that the proportions of potash salts in the chlorids of sea-water and saline waters generally, does not equal more than two or three per cent. As to the St. Lawrence, although the basin of Lake Superior in which the river takes its origin is surrounded by ancient sandstones, and by crystalline rocks, it afterwards flows through lakes whose basins are composed of palæozoic strata which abound in limestones rich in gypsum and salt, and these rocks have given the waters of this river that predominance of soda, chlorine and sulphuric acid which distinguishes it from the Ottawa It is an interesting geographical feature of these two rivers that they each pass through a series of great lakes, in which the waters are enabled to deposit their suspended impurities, and thus are rendered remarkably clear and transparent.

The presence of large amounts of silica in river waters is a fact only recently established, by the analysis by H. Ste. Claire Deville of the rivers of France.† The silica of waters had generally been entirely or in great part overlooked, or had, as he suggests, from the mode of analysis adopted, been confounded with gypsum. The importance in an agricultural point of view of such an amount of dissolved silica, where river waters serve for the irrigation of the soil, is very great, and geologically it is not less significant, as it marks a decomposition of the silicious rocks by the action of water holding in solution carbonic acid, and the organic acids arising from the decay of vegetable matter. These acids combining with the bases of the native silicates, liberate the silica in a soluble form. In fact silica is never wanting in natural waters, whether neutral or alkaline, although proportionately much greater in those surface waters which are but slightly charged with mineral ingredients. The alumina, whose

* Geological Survey of Canada, 1853.

† *Annales de Chimie et de Physique*, 1848. vol. xxiii., p. 32.

presence is not less constant, although in smaller quantity, equally belongs to the soluble constituents of the water. The quantity of silica annually carried to the sea in solution by the St. Lawrence and similiar rivers, is very great, and doubtless plays an important part in the silification of organic remains, and in the formation of silicious deposits, both directly and through the intervention of silicious infusorial animals.

BOOKS :—THE KIND TO READ, AND THE WAY TO READ THEM.

A LECTURE, BY THE REV. ADAM LILLIE, D.D.

The subject to which your attention is invited this evening—"Books: the kind to read, and the way to read them"—is one of great practical moment. *A book is a power*. One page of what it contains, nay a single sentence, may lodge a principle or give an impulse which shall continue to operate and bear fruit through life; may impress a character never to be effaced; may open a spring which will flow for ever. Books, then, are things which require to be carefully handled. There are multitudes living at this moment who have been made, to a large extent, what they are through the books they have read; and through the same instrumentality the characters of others are being formed and their destiny prepared. You live in the midst of this potent influence, which will operate for your advantage or your damage as your choice may determine. To assist you in turning it to the best account, will be our aim in the suggestions we have now to offer.

With respect to the kind of books to be read, we would say:

1. Let them be such as have a useful tendency.

The motives which induce reading vary with the characters and tastes of the readers. With one class the chief design is to while away time, which is felt to hang heavy on their hands; with a second it is the obtaining of relaxation and refreshment after exhausting exertion; with a third the securing of the pleasure which the exercise affords; with a fourth the gratification of an artificial appetite for excitement; while there are others, and we hope their number is not few, whose aim is self-improvement, by way of preparation for usefulness.

Of these ends, the first—the desire to kill time, as it is technically expressed—is unworthy of a being gifted with reason, because inconsistent with any correct view of our circumstances or duty. The portion of time allotted us here is so small in comparison with the multitude of things which must be done, if the ends of our being are to be answered in any fair measure, that he to whom most of it is given has not a moment which he can afford to waste. To themselves the parties owe it, had none others—God or man—claims upon them, to wake up and apply themselves to some serious occupation, through means of which they may, should they do nothing more, give themselves an opportunity of learning what life, true life, is—how much of dignity and glory it includes, as well as seriousness. What a character they give themselves! For any one else merely to insinuate that they were such arrant triflers would be a mortal offence.

But the time of which we find ourselves in possession is not our own, to be used as we please. Others have a claim upon it—He especially who bestows it on us. Him and them we defraud of their right by misusing it—a course of action for which an account will have to be rendered.

The reader for excitement, though apparently the antipodes of the time-killer, is actuated by a motive not one whit more rational or respectable than that which influences his drowsy neighbour. Substantially, their governing principle—if it be not a misnomer to speak of either as being governed by any principle—is one and the same, to wit, a morbid animal feeling, which manifests itself in the one case in an immoderate love of repose, while in the other it assumes the character of an equally immoderate propensity to constant and violent movement. Our emotional feelings have been given us to prompt to the varied action to which duty calls, and to sustain us in it. To consume them in mere gratification, is to act a part at once criminal and degrading; criminal, because it involves the mis-appropriation of a trust; degrading, because it proclaims the party so acting to care for none but himself, and shows the notions he has formed of self-gratification to be mean and unmanly.

Of the common practice of novel reading, the divorcing of feeling from its legitimate purpose—the business of life—is an all but inevitable result. Facts show it to be so, weeping over feigned distress being, among this class of readers, much more common than earnest, self-denying exertion for the removal of that which is real. It was not, we may venture to affirm, from this source Miss Nightingale caught the inspiration which has immortalized her name.

The other motives which we have described as actuating readers—the refreshment, to wit, of their minds when exhausted by exertion, the enjoyment of a rational pleasure, and the desire of improvement, are all legitimate and in harmony with one another; so that they may be pursued with a good conscience, and together.

In dignity, the last of these ends, the wish for improvement stands without question first, consequently it should be kept ever paramount. But the reading which improves may also afford pleasure and relaxation. This it will do, unless of such a nature as to overtax the powers, a thing of which there is danger in the case only of the student. With him even it is the measure rather than the kind of reading which burdens, use converting subjects the most exact or abstruse, within certain limits, into an agreeable exercise—a source, in fact, of intense delight.

Let not improvement be lost sight of, should necessity—exhaustion of mind or body—compel you to make at any time relaxation or refreshment your first care. In reading, seek these through means which will at the same time instruct and inspire with honorable sentiment, and prompt to generous and becoming action. Say not you are without taste for this or that. Your duty is to have a taste for it if in its tendency it be beneficial; your business to form such a taste, which a reasonable measure of determination will enable you to do with ease. The power of habit is in this respect very great. Such a taste forms, moreover, in the moral sphere, a counterpart to the instincts which excite our admiration in the animal world—which at once direct their possessor to the discovery of what is serviceable, and give him protection against what would do him harm.

Of that which is polluting it will ensure the immediate and infallible rejection, whatever the disguise under which it may conceal itself, or the vehicle in which it may be attempted to be administered. Is it not strange that parties who feel it a duty to be careful as to the company they keep, should be found indifferent about the character of the books they read? Yet are there multitudes with whom it is so. They will yield their minds without suspicion to those with whom they would not trust their persons for a moment, those in whose company they would on no account be seen, those the imputation of acquaintance with whom they would resent as an insult and a slander. Beware! A book is the mind of its author in a state of action, his inner life concentrated and brought into a state of connection with your mind and heart. While you read the process of transference is going on, and through that the process of assimilation. How large the quantity of poison which is in circulation, and how sad the havoc it is making! Penitentiary offences are made of things which have in them much less of moral obliquity than is involved in the producing, or printing, or selling of a corrupting book. Yet, for profit, parties are to be found mean enough and unprincipled enough to perform these acts; while the community which consents to be largely taxed for the repression and punishment of the lesser criminals, has not for these greater one word even of reprobation. In relation to these matters a healthier tone is much wanted.

Books of the following classes are well adapted to secure the legitimate ends of reading—to instruct, and improve, and prepare for honourable action, while they interest, and please, and refresh; to interest, and please, and refresh while instructing, and improving, and fitting for usefulness, viz.: History, biography, travels, descriptions of customs and inventions, poetry and general literature, the physical sciences, natural history, and philosophy, intellectual, moral, and political.

To master the whole of these subjects would be the work of a life—a long and laborious life—if even that would accomplish it. But to secure a serviceable acquaintance with them—such an acquaintance as will afford valuable aid in the work of life, and at the same time give a grace to the character, and supply a source of ever fresh and worthy enjoyment—is by no means difficult, so difficult at any rate as is by many supposed. None of them can well be dispensed with, whether viewed in themselves or in relation to the completeness of our knowledge. History sets before us human society in movement and action, while biography familiarizes us with individual life. Travels show us man as modified by climate, circumstances, laws, institutions, and prevailing opinions. Notices of customs and inventions furnish an exhaustless source of suggestions which may be turned to good account. Poetry and general literature charm, and instruct, and elevate. The physical sciences and natural history enlarge our conceptions of the wisdom, and might, and goodness of God, and augment our power; while philosophy informs us as to the principles of God's government over us, and acquaints us with the provisions made in the human constitution for the accomplishment of its purposes.

Between the larger part of these topics there exists a relationship which facilitates their comprehension and acquisition. At the same time, the variety they include affords room for choice, so that he who feels that he cannot undertake all, may select what his tastes lead him to prefer. Being all honourable he can do this without violating propriety; while their usefulness ensures his being a gainer on whichsoever of them his choice may fix.

The books you read we would recommend to be,

2. The best of their respective class within your reach.

To entitle a book to the character of good in relation to the subject of which it treats, two things are indispensable, to wit, that the matter be such as shall do the subject justice, and that its mode of presentation be such as shall do justice to the matter. The best book is the one which combines these two requisites in the largest measure.

From the use of works of this class a threefold advantage accrues. They render the reader the most effective aid in the accomplishment of the object for which he has recourse to them, whether pleasure or improvement; they will be found, generally speaking, to contain least of what needs to be rejected; and they will exert the happiest influence on the taste or general habit of the mind—a consideration of very great importance.

Be willing to put yourselves to a little trouble, and, if need be, expense, to procure first-class works; as the reading of books of an inferior description is a waste of the time bestowed on them, and, what is worse—much worse—a means of deteriorating the reader's mind.

To supply here anything like a list of the sort of books we have in view is an impossibility, as it would much more than fill what of space remains to us. Nor is our doing so needed, were it practicable. But we may name, by way of specimen, such works as Robertson's, Prescott's, and Macaulay's histories; Livingstone's Travels; Hugh Miller's Treatises; Macnish's Philosophy of Sleep, Sir Walter Scott's Letters on Demonology and Witchcraft, Schoolcraft's Indian Tales and Legends, Jouffroy's Ethics; in the department of mind, Locke, Reid, Stewart, Sir William Hamilton; and in Poetry, the productions of our better authors—works which will interest quite as much as profit.

With works of Imagination as such we have no war to wage; still their use should be kept within reasonable bounds. Their engaging a very large share of our attention, or occupying any very large proportion of our time will interfere with more important and more profitable employments, and produce an unfitness for them. The world in which we live is real, hence the more of reality there is in our mode of looking at things the better shall we be qualified to deal with it.

Whatever their recommendations in other respects let nothing induce you to tamper with what would contaminate. The perverting, or even blunting of the moral sensibilities, is much too large a price to pay for being interested or amused. We connect amusement with interest because we have nothing to object to it. We may be morally benefitted by a laugh as well as exhilirated, but in mirth we must be on our guard as well as in our more serious moods.

In relation to the way in which books should be read, our advice is,

1. To peruse them with attention.

This they deserve, if worth reading at all, which they will be provided the principles we have been

urging are acted upon. Attention is essential if we would possess ourselves of the contents of the books we read, or have awakened within us the emotions which it is their aim to excite, or be moved to the action to which they exhort. It is so also if we wish to retain what we gather from them, or be permanently affected by it. Just as objects on which we seem gazing may pass before the eye without making impression, so may ideas with which we may fancy ourselves engaged pass before the mind without imprinting themselves upon it. This they certainly will do, in the latter case not less than the former, unless singled out and looked at—viewed on every side and in every aspect, till we have completely acquainted ourselves with their nature, and afforded them opportunity of acting upon us.

As a matter of course the retention of an idea which we have failed to catch is an impossibility. This failure in catching—the result of inattention—is the grand reason why so little of what is read is retained. It is not the memory which is at fault, but the party reading.

The measure of attention which a book requires depends partly on its subject, partly on its mode of presenting the matter dealt with, partly on the familiarity or non-familiarity of the reader with the topics of which it treats, and partly on the state of his mind as to culture, the power of comprehension to which he has attained. Be the measure required what it may, his business is to bestow it, or dispense with the perusal of the work altogether. In the professed attempt to possess himself of its contents there is involved a pledge of the necessary attention.

From inattentive reading there arises a threefold mischief, namely, the loss of the time spent on the work, or a proportion of it at any rate, if not the whole; the formation of a habit of trifling, which will prove a source of abiding evil, detracting from the fruitfulness of future attempts; together with the deceiving of the reader, who will be apt to believe the amount of his knowledge to correspond with the number of the books he conceives himself to have read.

The power of attention is, to a large extent if not entirely, an acquired thing—the result of the habit of attending; and is hence within the reach of any one who will put himself to a reasonable measure of trouble. Once acquired it will largely repay the pains which its acquisition may have cost.

For the relief of the attention those who read much will find it a good plan to vary their books or their subject; or to discontinue their reading for a time when they find fatigue being produced. A few minutes spent in moving freely about their room will send them back to their work with their original freshness and power.

We counsel you;

2. To make a free, yet careful use of your judgment in relation to what you read.

You have a mind, as well as the author you may be perusing; hence you have a right to think as well as he. That right he admits, for he addresses himself to your reason. To act otherwise would be to forfeit all claim on your attention by insulting you.

But the exercise of your judgment is not less your duty than your right. To yourself you owe this—to prevent your receiving what should be rejected, or rejecting what should be received; by either of which courses you subject yourself to damage. You owe it to your author, whose end in addressing you cannot otherwise be attained, and against whom you otherwise bring by implication a charge of supplying you with nothing on which to form a judgment. You owe it, in addition, to truth, of which you can on no other condition either perceive the evidence or feel the power.

In exercising your judgment it is incumbent on you to act with carefulness as well as freedom. Neither condemn nor approve without valid reason. With independence mingle modesty, a quality becoming in all, but especially the professed learner; and as essential as becoming if we would be saved from mistake and its consequences, which are so often serious.

By such an exercise of attention and judgment as we have been recommending, you will, moreover, promote largely your mental advancement, in addition to the other benefits which you may anticipate from it.

We counsel you;

3. To read in the exercise of a spirit of candour.

Make truth your one object of pursuit, and accept it loyally wherever you meet with it. Be not offended with what may happen to contradict your notions, merely because of its doing so. Read anything of importance which may have been written in opposition to your views, as well as what has been produced in their favour. In this way you will have a chance of being set right, should you happen to be wrong; while, if you are right, you will be likely to be confirmed, to have your confidence in the correctness of your opinions and your feeling of their value increased. Objections to your belief may be the means of suggesting arguments in defence of it which might not otherwise occur to you. Your interest lies not in having the ideas you hold proven to be correct, but in the fact of their being so.

You will not understand us as recommending that you hold loosely the opinions you may have formed, or be occupying yourself constantly in their reinvestigation, as if faith were a crime or scepticism a virtue; but simply that you should avoid intrenching yourself behind the idea of your own infallibility.

4. Take reasonable pains to master the meaning of the author you may be perusing.

Till that is got nothing is done, inasmuch as it is only by what you understand you can be either instructed or moved.

To possess yourself of your author's meaning, apply, honestly and intelligently, to his language the rules by which the signification of written speech is ordinarily determined. As far as practicable place yourself, at the same time, in the circumstances amid which he wrote. Through this means you will acquire a sympathy with him, which will greatly facilitate your comprehension of his ideas.

In the case of works of special importance or difficulty, you will find it worth your while to review carefully what you read. Each re-perusal will throw fresh light on what you may have imperfectly apprehended, perhaps reveal to you something you may have overlooked altogether, and deepen the impression which may have been made on your mind.

You will find it also of service to make occasionally an abstract of what you read. This will enable you to test your knowledge of it, will assist you in making it your own, and will train you to a habit of careful reading, and of correct and ready judgment.

We recommend you;

5. To make what you read the subject of frequent thought.

By so doing you will at once treasure it up in your memory, ready for use when it may be wanted, and increase your acquaintance with its relations or bearings—two matters of great importance. You will, moreover, likewise furnish for your mind healthful and improving employment.

Similar benefits will result from the habit of making what you read the subject of intelligent conversation, inasmuch as that will compel you to throw your thinking into a definite shape, and will bring out in relation both to it and its subject the opinion of the party with whom the conversation may be maintained.

We advise you ;

6. To communicate what you read to others as you obtain opportunity.

As in the case of conversation the effort to place the topic with which you may undertake to deal before the mind of the party you propose instructing, in such a way as may best secure its comprehension, or induce its acceptance, or make it productive of the effect natural to it, will exert a reflex influence on your own mind—the responsibility you have voluntarily assumed acting as a stimulus to your powers, and inducing exertion to inform yourselves on the points in regard to which you may be conscious of deficiency. This educating of himself through means of his labors for the education of others is recognized by the intelligent Teacher as constituting a very material part of his reward, as, in fact, constituting often its best part.

For such engagements Mechanics' Institutes and Debating Societies, when wisely conducted, afford valuable facilities. Indeed we would look on the culture and bringing out into public service of the mind of their members, as constituting at once one of their most imperative obligations, their most delightful employments, and their best grounds of claim upon the community.

We add the further recommendation ;

7. That you apply, as often as occasion may offer, what you read to practice.

In this way you will be gratified and encouraged by the discovery of the usefulness of what you may have learnt ; and will have valuable hints suggested to you for your guidance in your further endeavours.

We cannot, of course, promise you that you will on the system we have been recommending, go through the same quantity of reading within a given time as you would do by a more cursory perusal of the works on which your attention may be bestowed ; but we can do what is very much better, namely, promise you a greatly increased measure of enjoyment and profit. In the case of the mind, as of the body, it is the assimilation of the food taken that nourishes, not its mere quantity. But to assimilation digestion is essential.

In the counsels we have been giving, we have presupposed, as you will have perceived, the habit of reading to be in existence on the part of those to whom we have been addressing ourselves. Should there be any portion of our audience, even a single individual, with whom it is otherwise, we would, ere we close, urge on him or them the formation and cultivation of this habit. If knowledge be power, the acquisition of it becomes a duty, because of the opportunity of using it with which the intercourse of life is constantly supplying us, and because of the demands for its exertion which the circumstances in which we are placed are constantly making upon us. On the same principle its acquirement must be recognized as constituting the object of an honourable and becoming ambition.

On the younger portion of our audience especially we would urge with all earnestness the cultivation of this habit. In addition to the other advantages you may anticipate from it, of which we have already spoken, it will help to protect you against influences deteriorating in their tendency and ruinous in their consequences, to which you stand exposed on every hand ; whose mischievous power is increased by the guise which they not unfrequently assume, and the appeal made by them to feelings incident to your years, which, though in themselves honourable, require to be held under regulation.

Placed as you are in a country which supplies you with a sphere of action so wide and of an order so high, and holds out to you rewards so large and honorable, the responsibility resting on you to make the best of yourselves is very serious. Be it your aim, let it be a matter of principle with you, so to act as to prove your consciousness of the obligation under which you lie and appreciation of the privileges you enjoy ; above all, as to manifest your gratitude to their kind bestower, to secure His approval, and to realize His blessing now and for ever.

CONDITION AND PROGRESS OF FOREIGN COUNTRIES IN MANUFACTURING INDUSTRY.

No. 1.—Sweden.

The population of Sweden, during the years named was as follows :

	Men.	Women	Total.
1855......	1,764,118	1,875,214	3,639,332
1856......	1,781,641	1,890,788	3,672,429
1859......	1,786,010	1,898,023	3,687,033

Which would give about 470 inhabitants to the geographical square mile (German).

Belgium is stated to possess 8,442 inhabitants to the geographical square mile.

The Public Debt of Sweden has been incurred exclusively in the construction of railways ; it consists at the present moment of the very reasonable sum of 1,112,000*l.*, bearing interest at the rate of 4½ per cent. per annum, and entailing an annual charge, with the Sinking Fund, of 65,000*l.* This debt, which is now quoted on the Hamburgh Exchange at about 97, will be totally extinguished in the year 1898.

The number of miles of Railway actually open to traffic amounts to 253 English miles. The grand total of completed and projected Railways is about 1,100 miles. The estimated cost of the Government lines amounts to 7,100,000*l.* Sterling.

The total value of imports from abroad in 1858 was 3,166,00*l.* Sterling, and of exports 3,722,000*l.* Sterling, a great diminution as compared with the years 1855 and 1856. In the latter year the imports were valued at nearly double the above amount and the exports exceeded 5,000,000*l.* Sterling.

The total quantities of metals shipped from Stockholm, during 1859 were 1,026,042 centners, an increase, as compared with 1858, of 217,179 centners. Of these, 342,737 centners went to England, against 172,196 in 1858. The stock on the 31st of December last was 675,245 centners, against 636,402 in 1858.

All the rails, and most of the locomotives, required for the railroads are imported from England, as also

the whole of the mains and pipes for the water-works, which have recently been laid down in the city. The Swedish iron, although of excellent quality, cannot be produced at a price to make it available for ordinary purposes. One of the principal iron works in the country recently offered to supply the Government with a very limited quantity of rails, made of Swedish iron, at about 12*l.* 10*s.* the ton, and with ten locomotives, on the model of those now in use (which were made in England), at the price of 3,000*l.* per locomotive. It is calculated that, at the above price, the rails would cost from 15 to 20 per cent. more than British rails, and the locomotives 10 pere cent. more than those imported from England. Locomotives will eventually be made here almost, if not quite as cheaply as in England, as the Swedes are already able to manufacture all the marine engines they require, and even to execute large orders for Russia.

The quantity of sugar entered at Stockholm in 1859 was 15,000,000 lbs.; of coffee, 7,120,210 lbs.; and of tea, 25,185 lbs.

The trade of the port of Gothenburg continues to increase so rapidly that there can be little doubt it will eventually absorb the greatest portion of the foreign trade of Sweden. Already the Customs duties levied in that port have, in seven recent years, exceeded the receipts of the port of Stockholm, and the completion of the railway between the two places will give an additional advantage to Gothenburg.

The export of iron in 1859 shows a considerable increase over any previous year. The total quantity exported was 969,730 centners, of which 601,857 centners were shipped to England, and 191,220 centners to the United States.

Of deals, battens, and boards, 294,702 dozen were exported, against 205.057 dozen in 1858, and this is stated to have been the best year ever known. Of the above quantity for 1859, 138,660 dozen were shipped to England, and the equalization of the duty on foreign timber will, doubtless, give a still further impetus to this branch of Swedish exports to the United Kingdom.

The grain export amounted to 2,218,185 cubic feet of which 1,474,017 cubic feet went to England.

If, therefore, Sweden should continue hereafter to export grain in an ordinary year to the same extent, the value of her excess of exports over imports may be taken, without exaggeration, at 800,000*l.*; a most encouraging prospect, when it is considered that the total value of her exports of all kinds in 1858 was only 3,700,000*l.*, and that so recently as the year 1820 she imported annually upwards of 100,000 imperial quarters of grain from abroad.

Lucifer matches valued at 275,179 rix-dollars were exported from Gothenburg, the greater part of which were intended for the British market.

Statement showing the Quantities of Iron and Copper produced in Sweden, in 1858, *and the Number of Persons employed.*

	Number of Furnaces & Forges.	Quantities in British tons.	Number of Persons employed.
Pig iron	261	121,356	15,429
Castings	....	5,131	
Bar iron	386	104,148	
Other kinds of iron and steel	....	14,816	
Copper	....	1,660	1,773

Comparative Statement of the various Manufactories existing in Sweden, in the years 1857 *and* 1858 *respectively.*

	1857.		1858.	
	No. of Factories.	Value of product in Rixdollars	No. of Factories.	Value of Product in Rixdollars
Cotton and Linen	30	3,435,437	31	3,637,729
Cloth	105	10 621,887	105	7,359,267
Silk	9	916,392	7	557,353
Ribbon	10	77,306	10	64,084
Cotton spinning mills	20	10,479.372	20	7,709,819
Sail cloth	7	513,666	8	532,875
Stocking	18	447,210	17	409,267
Sugar refineries	13	13,640,547	10	10,660.582
Tobacco	95	4,711,077	100	3,841,649
Paper	80	1,946,349	87	2,187,250
Leather	561	3,700,419	591	3.413,594
Dyeries	432	1,250,299	448	1,095,023
Cotton printing	19	117,228	17	64,768
Glass	17	1,305,572	18	1,371,928
Porcelain	2	874,879	2	749,453
Earthenware and Stoves	54	329 312	53	336,424
Oil-pressing	49	1,223,560	44	1,255,354
Porter brewers	2	776,535	2	625,818
Tallow candle	12	735,751	14	256,398
Stearine candle	3	458,475	3	368,350
Soap-boilers	9	647,965	12	745,846
Rope	20	267,673	21	219,200
Clocks	126	69,141	130	64,659
Playing cards	10	87,022	9	40.664
Carpet	14	148,567	14	125,542
Chemical works	13	156,678	13	59,741
Coach makers	19	259,330	17	195,550
Chemical matches	10	236,907	19	365 240
Machinery works	37	3,311,308	47	2,901,160
Various minor works	598	1,875,174	594	1,494,954
Total	2,394	64,621,038	2,463	52,709,541
Motala Machinery Works	....	1,143,142	....	1,433,787

18 rixdollars = about £1 sterling.

One American dollar = to 4 rixdollars nearly ($3 94).

The number of Looms in operation in 1857 was 4,291, giving employment to 27,433 persons; in 1858 the number of looms was reduced to 3,758, employing 25,808 persons.

No. 2.—Denmark.

The commerce of Denmark consists, besides a considerable carrying trade, in the exchange of the raw produce of the country for manufactured goods and fruits of the south and trans-atlantic productions.

The foundation for the trade is the produce of agriculture, which, together with the breeding of cattle, forms the chief source of revenue to the country.

Although the progress of agriculture and commerce has of late been much impeded by the losses and temporary stoppage of trade caused by the late monetary crisis, and the political embarrassments which still exist, it has, notwithstanding, been considerable; this in a great measure has been produced by the large sums granted by the Diet for the promotion of professional knowledge, and by the foundation of institutions for acquiring agricultural and other sciences, and when the restraints which still impede industry are removed, there is little doubt that still further progress will be made.

There are at present several agricultural schools for peasants and stewards, besides a large institution the neighbourhood of Copenhagen, where the high branches of agriculture are taught, and where sound instruction with reference to all the sciences relative to agriculture can be acquired in eighteen months, for the moderate sum of about 5*l.*

The result of these institutions has been that old customs have been set aside, and a more rational mode of agriculture adopted throughout the country; still, however, there remains much room for improvement. The art of draining, marling, and manuring has made much progress. Irrigation seems to be but little understood, nor is it, perhaps, in general much required in this climate.

The improvements in the science of agriculture have not only caused a great increase in the produce, but also great amelioration in the quality of the grain.

RAILWAYS.

Of these there exist at present in Denmark Proper one from Copenhagen to Korör, distance 68 English miles paying an interest of 3 per cent. (Government guarantee 4 per cent.)

In Schleswig there is a railway extending from Flensburg to Tonning, with a branch line to Rensborg, connecting it with a line from Kiel to Altona, with short branches at different towns.

MANUFACTURES.

The manufactures of Denmark are unimportant. Although some progress has been made during the last two years, it is not probable that it can ever become a manufacturing country, as the most important raw produce necessary to manufacturers, viz., iron, tin, coal, &c., are wanting.

The Government has, however, of late done much for diffusing knowledge and technical skill amongst artizans. In this respect the Polytechnic School and Academy of Arts at Copenhagen have been instrumental.

One of the reasons of the hitherto low state of Danish industry may be attributed partly to the threefold protection it has been subject to, but especially to the extensive rights hitherto enjoyed by the Guilds or Close Corporations; this system of guilds has been done away with by the Law of 19th December, 1857, to come into operation on the 1st of January, 1862, from which period probations of masters and journeymen will be abandoned, and an almost unrestricted industry will take place.

The manufactures of the country may be put down as follows:—

1. The distillation of corn-brandy, in which a considerable increase has taken place of late years; the produce in 1857 amounted to 47,000,000 quarts. It is taxed at 4 skillings (about 1*d.*) per quart, and adds considerably to the revenues of the State. Besides the consumption in the country, great quantities are exported, especially to Sweden and Norway, and calling ships.

2. *The Cloth Manufacture.*—Although the protective duty on this article has been considerably diminished it still amounts to 50 rix-dollars per 100 lbs. Consequently only the finer sorts of cloth are as yet imported; that of a coarser kind is manufactured in the country. Of this description they are only four manufactories of any importance in the country, viz., at Brede, near Lyngby; Greis, near Silkiborg; Brunshaas, near Viborg; and at Neumnister in Holstein. The quality produced is generally coarse and heavy. The peasantry and the army and navy are principally supplied.

The manufacture of this article has somewhat increased.

The importation of fine cloth is valued at about 6,000,000 rix-dollars.

3. *Paper Manufactories.*—There are six of this kind The paper produced is in general of inferior quality. Some better kind of letter paper is manufactured, but in very small quantity. The best used is English or French.

The manufacture of this article has much increased. Formerly a very heavy protective duty existed both on paper and rags; this has been reduced, but it is still high. The import duty is now from 4 rix-dollars 48 skillings to 2 rix-dollars 16 skillings, and the import duty 1½ rix dollars per 100 lbs.

4. *Sugar Refineries.*—Of these they are six of importance. The quantity produced annually is about 30,000,000 lbs., and the average value about 700,000*l.* The manufacture has increased of late years. The import duty on sugar is 4 rix-dollars 66 skillings per 100 lbs.: of this amount, however, only about 1 rix dollar 32 skillings is protecting duty, the remainder being import duty on the raw produce.

5. *Iron Works.*—They are six of these of any importance, besides several smaller foundries for manufacturing stoves, pots, and pans, &c. The only manufactory of machinery is that of Messrs. Baumgarten at Copenhagen, who have built some steam-engines for the naval and postal service. The greater part of agricultural implements used are manufactured in the country. The principal iron works are at Copenhagen, Frederichsburg, Odense, Flensburg, Kiel, and Rensburg. This manufacture has also increased of late years, although the protecting duty has been reduced.

6. *Ship Building.*—There are 29 ship-building yards in Denmark. The principal ones are those of Assenrade, Svendborg, and the Island of Bornholm; but few are built at Copenhagen, as the cost of the material and other expenses are too high. The merchant fleet was, however, increased in that year by 141 vessels of 16,410 tons burthen. No private steamers were built; they are generally purchased in Great Britain, principally in Scotland. Ship-building in general has considerably improved.

7. *Oil Mills.*—There are twenty-one oil mills; the principal ones are at Copenhagen, Aarhuus, Horsens, Faaberg, Flensburg, Kiel, and Altona. The production annually of linseed and rape oil is about 3,000 English tons (Altona not included), and of linseed and rape cakes about 6,500 tons (Altona not included); value of oil about 1,700,000 rix-dollars, of cakes about 325,000 rix-dollars. This manufacture has also increased, but in 1858 there was a great decrease on account of the previous monetary crisis.

Brick and lime manufactures have considerably improved.

The manufacture of soda and alum from the new mineral cryolith lately discovered in Greenland has also some importance.

The Mechanics' Institute at Leeds.

It is intended that the accommodation of this building shall comprise a reading room and library; a lecture hall capable of seating 2,000 persons; class accommodation for 800 pupils; a gallery of art eighty feet by thirty feet; a school of art for 300 pupils; and a school of science and chemical laboratory for 100 pupils. The estimated cost of the building is fixed at £16,000, which sum will include the price of the land. The total amount already received in aid of the new building fund is £5,005.

THE OTTAWA SURVEY.*

The questions upon which information is sought, and to answer which the survey has been carried on during the past year, are as follows:

I. To determine the practicability of a navigation for vessels of the larger class, between Montreal and Lake Huron, by way of the River Ottawa and its tributary, the Matawan, Lake Nipissingue, and French River.

II. To ascertain what scale is best suited to the nature of the route.

III. To give a reliable estimate of the cost of the improvement.

In the first place, I have to report that the distance between Montreal and the mouth of French River, on Lake Huron, (according to the plans furnished me by the Department,) is, following the line of navigation adopted, 430.76 miles.

That, of this distance, 351.81 miles are already a good natural navigation, and require no improvement, and that it is perfectly practicable so to improve the remaining 78.95 miles, as to convert the whole chain of waters into a first class navigation for steam vessels, and to reduce the length of canalling to 29.31 miles, or, exclusive of the Lachine Canal, to 20.82 miles.

Secondly, the scale of navigation attainable, and which I would recommend as best suited to the capabilities of this route, is calculated for vessels of one thousand tons burden, and has locks 250 feet long by 45 wide, by 12 feet depth on the mitre sills.

Finally, a careful estimate, resulting from a close instrumental survey of all obstructed points, the details of which will be found hereafter, enables me to state that the cost of this improvement, exclusive of interest, legal expenses, and damages, none of which I have any means of ascertaining, will not exceed the sum of $12,026,354, distributed as follows:

OTTAWA AND FRENCH RIVER NAVIGATION.

	Distances.		Levels.		Cost.
	Rivers & Lakes.	Canals.	No. of Locks.	Feet Lockage.	
Lachine Canal	....	8.50	5	43.75	Not estimated
Lake St. Louis	13.31	....	......	....	do.
Saint Anne's	....	1.19	1	1.00	469672
Lake of Two Mountains	24.70				
Carillon to Grenville	7.73	5.00	7	58.50	1649909
Green Shoals	....	0.10	......	....	136105
Ottawa River	55.97				
Chaudière and des Chênes	3.75	2.61	6	63.00	816733
Des Chenes Lake	26.69				
Chats	1.70	0.60	5	50.00	681932
Chats Lake	19.28				
Snows to Black Falls	18.32	1.05	11	104.00	1256840
River and Lake Coulonge	24.93	....	......	....	262414
Chapeau and L'Islet	4.85	0.14	2	18.00	243507
Deep River	33.58				
Joachims to Matawan	51.74	2.26	14	148.20	1757653
River Matawan	16.22	1.08	11	144.00	1162154
Summit level and cut	51.15	5 97	......	....	2160369
French River	47.52	0.82	7	77.00	886117
Add Engineering and Superintendence	....	....	......	....	574175
	401.44	29.32	64	665.70	12057680

* Extract from the Report of T. C. Clarke, Esq., Engineer of the Ottawa Survey.

There are, exclusive of the Lachine Canal, 20.82 miles of Canals, costing $12,057,680, which is equal to $571,934 per mile of Canal. But the cost of the whole navigation from St. Anne's to Lake Huron, 408.76 miles, is but a trifle under $29,500 per mile.

COMPARISON OF ROUTES—CHICAGO TO MONTREAL, *via* ST. LAWRENCE AND OTTAWA.

Name.	Miles.					Number of Locks.	Lockage.	Current.	Total Rise and Fall.
	Open Navigation.			Canals.	Total.				
	Lake.	Inland.	Total.						
	Via ST. LAWRENCE.								
Lachine	......	....	....	8.5	....	5	43.75		
St. Lawr'ce & Welland	......	....	....	60.5	....	49	490.00		
	1145	134	1279	69.0	1348.0	54	534.75	26.5	561.25
	Via OTTAWA.								
Lachine	......	....	....	8.05	....	5	43.75		
Ottawa	......	....	....	20.52	....	64	665.70		
	575	401.74	976.74	29.02	1005.76	69	709.45	21.4	730.85

A Summary of the Tonnage on the Lakes, and River St. Lawrence, October, 1859.

	No. of Vessels.	Tonnage.	Total Tonnage.
UNITED STATES.			
Lake Steamers	41	39,477	
River Steamers	16	2,324	
Tugs [side wheel] River	9	1,825	
Ferry Boats [side wheel]	2	122	
Lake Propellers	105	53,749	
River Propellers	7	550	
Lake Tugs [Propellers]	35	4,347	
River Tugs [Propellers]	31	1,722	
Ferry Boats [Propellers]	2	568	
			104,684
Barques	43	17,515	
Brigs	79	22,860	
Schooners	832	174,258	
Sloops	4	152	214,785
American Vessels	1,206	Tonnage...	319,469
CANADIAN.			
Lake Steamers	22	10,188	
River Steamers	25	7,859	
River Tugs [side wheel]	12	3,322	
Ferry Boats [side wheel]	3	2,288	
Lake Propellers	14	4,285	
Lake Tugs [Propellers]	3	357	
River Tugs [Propellers]	3	117	
			28,416
Barques	18	5,946	
Brigs	15	3.630	
Schooners	210	32,498	
Sloops	4	244	42,318
Canadian Vessels	329	Tonnage...	70,734
Grand Total	1,535	....	390,203

Decline of the Shipment of Grain through the Lakes, in 1859.

Reliable sources give a return of only 14,800,000 bushels of grain as shipped Eastward from the Lake Regions over Lake Ontario, in 1859, against 21,800,000 in 1858, 18,044,000 in 1857, and 23,800,000 in 1856.

Facts in Industrial Zoology.

Since the Christian era, the only additions to the domesticated animals of Britain, have been four in number.

In 1524, the Turkey.
In 1650, the Musk Duck.
In 1725, the Gold Pheasant.
In 1740, the Silver Pheasant.

The number of species of animals in the world, is one hundred and forty thousand, and yet the attention of mankind is limited generally to but forty-three domesticated species.

In 1800, the first wool was imported from Sydney, amounting to 658 bales. In 1858, the quantity of wool imported into Britain from Australia, amounted to 51,104,560 lbs.

In 1834, the export of Alpaca wool from South Australia, was 5,700 lbs.; in 1842, it amounted to 1,458,000 lbs.; and in 1857, Mr. Titus Salt used in his manufactory for the purpose of mixing the wool with cotton in the warp, the enormous quantity of 3,000,000.

The Eland, a South African deer of large dimentions, is being introduced into the parks of English noblemen, and is already acclimatized.

There are forty-two specimens of deer in the world, and until recently only three were generally distributed in parks, or existed in the wild state in Britain. They are the Red Deer, the Fallow Deer, and the Roebuck. Efforts are now being made to introduce the Wapiti, the Barbary Deer, the American Virginian Deer, and the Moose or Elk of Canada.

Viscount Powerscourt has now in his park, near Dublin, one bull Nylgau, one cow ditto; two stag Wapiti, three hind ditto; one Barbary stag, one hind ditto; one Sambur deer, six hinds ditto; one Axis stag, two hinds ditto; one male Llama, one female ditto; one white hind: and about thirty-five red deer; all these are in good health, and the Nylgaus and deer breeding well.

The bison, or American buffalo, may now be seen cropping and thriving on Scottish grass in a magnificent park of the Earl of Breadalbane, in the North of Scotland.

The annual value of salmon alone to Scotland is no less than $4,000,000 per annum, and to Ireland, $1,500,000. With proper care of the young fish, there is no reason why this large sum should not in time be doubled.

The Board of Arts & Manufactures

FOR UPPER CANADA.

PROCEEDINGS OF THE BOARD.

Toronto, Jan. 22nd, 1861.

The adjourned Quarterly Meeting of the Board was held this day, at one o'clock, p.m.

The members present were:—Professor Buckland. University College, Toronto; Professor Hind, Trinity College University, Toronto; Dr. Beatty, President Cobourg Mechanics' Institute; John Shier, President, and John Bengough, Delegate, Whitby Mechanics' Institute; Thomas Sheldrick, President Dundas Mechanics' Institute; Dr. Craigie, Thomas Hilton and Alexander Stuart, Delegates, Hamilton Mechanics' Institute; Joseph D. Ridout, President, and J. E. Pell, W. H. Sheppard, John McBean, Benjamin Walton, Alexander Hamilton and William Edwards, Delegates, Toronto Mechanics' Institute.

Minutes of the former meeting were read and confirmed.

Letters were read by the Secretary expressive of satisfaction, on the part of the writers thereof, in respect to the design and general character of the Journal of the Board, as indicated by the first No. issued.

The Report of the Sub-Committee for the past year was read by the Secretary; it was then moved by Mr. Sheldrick, seconded by Mr. Ridout, and *Resolved*, "That the Report be adopted and ordered to be printed in the Journal of the Board for the ensuing month; and that 100 copies of the Report be also printed for the use of members."

Moved by Mr. Pell, seconded by Mr. Shier, and *Resolved*, That the Sub-Committee be instructed to offer the Journal of this Board to the various Literary, Scientific, and Agricultural Societies in the Province, on the same terms as to Mechanics' Institutes.

In accordance with notice given at a former meeting it was

Moved by Mr. Sheppard, seconded by Mr. McBean, and *Resolved*, That article XI. of the By-laws be amended by substituting the word "twelve" for "fifteen," in the first line of said article, as the number necessary to constitute a quorum of the Board.

Moved by Mr. Bengough, seconded by Mr. Hamilton, and *Resolved*, That in the opinion of this Board it is desirable that Mechanics' Institutes, in their several localities, should be placed in the same relation to county Agricultural Societies, as this Board holds to the Provincial Agricultural Association's Exhibitions in Upper Canada.

Moved by Mr. Bengough, seconded by Professor Buckland, and *Resolved*, That the thanks of this Board are due, and hereby tendered, to the Sub-Committee for the past year, for their praiseworthy exertions in supplying—through the Journal just issued—a want that has long been felt in Upper Canada, of a medium for distributing useful information in arts and manufactures, and also devoted to the interests of the Mechanics' Institutes of the Province; the Board also especially appreciates the services of Professor Hind, who has accepted the responsible position of editing said Journal.

The election of Office-bearers and Sub-Committee for the ensuing year then took place, which resulted in the election of the following gentlemen:—

President—John Beatty, Jun., M.D.

Vice-President—John E. Pell.

Secretary & Treasurer—William Edwards.

Sub-Committee—Messrs Dr. Craigie, Prof. Hind, Joseph D. Ridout, W. Hay, W. H. Sheppard, Prof. Hincks, Thomas Sheldrick, John McBean and Alexander Hamilton.

Moved by Mr. Sheldrick, seconded by Mr. Hamilton, and *Resolved*, That the Sub-Committee be instructed to obtain one or more wood-cuts for each issue of the Journal, whenever none are supplied gratuitously for that purpose—the expense to be incurred not to exceed the sum of ten dollars per issue.

The Board then adjourned.

REPORT OF SUB-COMMITTEE.

In compliance with the By-Laws of the Board of Arts and Manufactures for Upper Canada, the sub-committee elected at the last Annual Meeting beg to present the following Report of their proceedings.

During the year 12 Mechanic's Institutes, and one Board of Trade have connected themselves with this Board, either through their respective Presidents as *ex-officio* members, or by having accredited Delegates to take part in the proceedings, viz:—Ayr, Aurora, Cobourg, Dundas, Hamilton, London, L'Orignal, Stratford, St. Thomas, Toronto, Woodstock, and Whitby Mechanics' Institute, and the Board of Trade of the City of London. The Smith's Falls Mechanics' Institute contributed from its funds the sum of ten dollars, which amount your committee have appropriated to its library in books at reduced prices.

FINANCES.

The Treasurer's Audited detailed Statement, herewith submitted, shows total receipts $4,101.75; expenditure $1,605.91; leaving a balance in hand of $2,495.84: the whole of this balance, however, cannot be considered available, as an order has been given for books for the library that will amount to somewhere about $250, besides the sum of $225 offered as prizes for essays.

LIBRARY AND MODEL ROOMS.

The Library of Reference and Model Rooms have continued open to the public, free, during the year, and have been visited by a large number of persons seeking information connected with the Industrial Arts, and with Patented Inventions and Discoveries.

Your Committee have appropriated from the limited funds at their disposal, the sum of $500 for the purchase of books of Reference of a practical character. A portion of these works are already on the shelves of the Library; the remainder have been ordered from England, through the Society of Arts, thereby saving the usual discount to associated Institutes of 27½ per cent. on purchases made through that society. These books may be expected in the course of a few weeks.

The Library now contains upwards of 400 folio and octavo volumes of specifications, plates, indexes, &c., &c., of British and Canadian patented inventions, 135 volumes of Cyclopædias, Dictionaries, and works on the various Arts and Manufactures, 100 volumes of Statutes, Journals and Appendixes of the Legislature of Canada, and a large number of pamphlets containing parliamentary and other reports.

Eighteen of the leading British and American Mechanical and Scientific Journals are regularly received at the rooms.

It is proposed to arrange the works in the Library under the following heads, and to publish a catalogue as soon as practicable.

CLASSIFIED INDEX TO CATALOGUE.

1.—Alphabets, Writing, &c.
2.—Antiquities.
3.—Architecture, Engineering and Building.
4.—Biography of Artists, Engineers, Inventors, Manufacturers, &c.
5.—Decoration and Ornament.
6.—Dictionaries, Directories and Cyclopædias.
7.—Drawing, and Designing not embraced in class 3.
8.—Fine Arts.
9.—Geography, Topography, and Statistics.
10.—Horticulture and Agriculture.
11.—Manufactures, Trades, and Industrial Arts in general.
12.—Miscellaneous, and works treating on subjects in more than one department of the library.
13.—Natural History,—General.
14.—Naval Architecture.
15.—Patents of Inventions and Designs.
16.—Periodicals.
17.—Science—General.

Your Committee beg to acknowledge a donation from the Council of the Canadian Institute, of its Journal, for the five years ending December 31st, 1860, being a complete set of the new series of that valuable publication. The Patent department of the Bureau of Agriculture and Statistics has also furnished the Library with 2 copies of the first volume of Specifications and plates of Canadian Patents, embracing a period of 25 years, from 1824 to 1849. The second volume of this work is expected to be issued in April next.

The Model Rooms contain as yet, only the models of Canadian Patented Inventions, numbering about 500; your Committee would, however, suggest to the Board, that so soon as permanent accommodation is secured, an effort should be made to organize a museum of the manufactures of Canada, which should exhibit the products of the Province in all their various stages and processes of manufacture.

EXAMINATIONS.

During the past year your Committee have carried out the idea, long entertained by the Board, of organizing a system of periodical examinations of Mem-

bers of Mechanics' Institutes, for the purpose of encouraging and rewarding efforts made by the Industrial classes for self-improvement.

These examinations are open to all Members of Mechanics' Institutes and Library Associations in Upper Canada, who are over sixteen years of age, and are not Students of any college, graduates or undergraduates of any University, or certified school teachers, or who are not following any of the learned professions.

Programmes have been sent to the several Institutes in Upper Canada, and they have been earnestly invited to co-operate with the Board in carrying out the scheme. Your committee hardly expect that these examinations will be taken much advantage of during the present session, although they cannot but encourage the belief that next year, when the plans and objects of the Board shall be better understood, a large number of candidates will present themselves for examination.

The subjects appointed for the Final examinations in May next, are as follows:—

I.—Arithmetic.
II.—Book-keeping.
III.—Algebra.
IV.—Geometry.
V.—Mensuration.
VI.—Trigonometry.
VII.—Conic Sections.
VIII.—Principles of Mechanics.
IX.—Practical Mechanics
X.—Magnetism. Electricity and Heat.
XI.—Astronomy.
XII.—Chemistry.
XIII.—Animal Physiology.
XIV.—Botany.
XV.—Geology & Mineralogy.
XVI.—Agriculture & Horticulture.
XVII.—Geography.
XVIII.—Political & Social Economy.
XIX.—History.
XX.—English Grammar & Composition.
XXI.—English Literature
XXII.—French.
XXIII.—German.
XXIV.—Music.
XXV.—Drawing & Modelling.
XXVI.—Penmanship.

The following Table will show the estimation in which these examinations are held in England, under the management of the Society of Arts.

In 1859, the No. of candidates examined by 79 Local Boards, at the previous examinations, was 641
No. passed previous examinations 544
" examined at final examinations............... 480
" passed at final examinations..................... 368
" of papers worked at final examinations 766
" of first class certificates awarded.............. 78
" of second class certificates awarded........... 154
" of third class certificates awarded............ 308
" of prizes awarded.. 28
" of unsuccessful candidates........................ 112

Of the 368 who passed the final examinations, 95 were Mechanics, 151 Mercantile and Professional Clerks, and Book-keepers, and the remainder Engravers, Warehousemen, Teachers, Gardeners, Porters, Labourers, &c.

Age	No of Candidates.	Age.	No. of Candidates.	Age.	No. of Candidates.
16	52	26	11	36	2
17	68	27	8	37	2
18	77	28	6	38	1
19	64	29	4	39	3
20	54	30	9	44	1
21	44	31	6	43	1
22	36	32	5	44	1
23	23	33	6	47	2
24	16	34	1		
25	21	35	1		

As an evidence of the advantages likely to be secured to the holders of the certificates awarded by the Board, we give an extract from "an exposition of the Society of Arts examinations," published under the auspices of the Glasgow Athenæum in 1858. "If any thing were wanting to enforce the benefits accruing from the Society's examinations it might be derived from the approbation signified by the great number of Master Manufacturers, Railway Directors, and Bankers throughout England, and of the leading commercial firms in London and in the Provinces, which have declared their readiness to accept the certificates of the Society as a guarantee of proficiency."

The writer, also, after passing a high eulogium on British Governesses, as a class, remarks "Still, the respectability of the profession might be better appreciated, and their remuneration might be increased, if they were known to have passed a high examination of the Society of Arts."

These extracts and figures afford sufficient encouragement to the Board to persevere, although success may not for some consderable time crown their efforts.

JOURNAL.

When your Committee came into office, this Board was in communication with the Board of Agriculture with a view to entering into an arrangement to publish a Journal conjointly with that Board; after mature consideration, your Committee concluded that such a system as was contemplated would prove unsatisfactory in its working, and therefore decided to publish a Monthly Journal, of 32 pages each issue, entirely on its own responsibility. Tenders were at once obtained for the publication of such a Journal, and the contract was given to Messrs. Maclear & Co., of this city. Your Committee were also so fortunate as to secure the services of Professor Hind as editor of the Journal, and 2,000 copies of the first number have been issued.

The terms of subscription have been placed at the low sum of $1 00 per annum, or to clubs of ten or upwards 75 cents per annum; while to members of Mechanics' Institutes, when subscribing through their secretaries or other officer, it is supplied for 50 cents per annum.

As this Journal is intended to advocate the interests, and to be devoted entirely to the promotion, of the Arts and Manufactures of the Province, and at the same time to be made available as a medium of communication between the several Mechanics' Institutes of Upper Canada, your Committee look forward with confidence to a very liberal support being afforded to it by these institutions, as well as by all engaged in, or interested in the promotion of, the manufacturing industry of the country.

AMENDMENTS TO ACT OF INCORPORATION.

One of the first matters attended to on your Committee's acceptance of office was, in conjunction with the Board of Arts and Manufactures for Lower Canada and the Board of Agriculture for Upper Canada, to prepare certain amendments to the act constituting these several Boards. These amendments were submitted to a committee of the House of Assembly during the last meeting of the Legislature, but were not introduced to the House by Bill until so near the close of the session that it was found impracticable to carry it through. The principal objection your Committee had to this bill was, that it was prepared as a bill of amendments to the Old Act, instead of a New Bill; thus leaving it impossible to be understood unless read in conjunction with the act as found in the Consolidated Statutes.

Your Committee would recommend that an effort be made to have the present Act repealed, and a new one passed embracing the several amendments provided in the Bill of Amendments above referred to, during the approaching session of Parliament.

PATENT LAWS.

Your Committee think it highly desirable that amendments should be made to the Patent Laws of this Province, on the basis of a bill introduced by the Hon. Mr. Lemeiux in the session of 1859, giving to British subjects non-resident in Canada, and Foreign subjects, the right to obtain Patents in this Province on paying an amount equal to the fees and charges that may be payable, at the time of such application, by a Canadian inventor to secure a Pateut in the country of the applicant.

Restricting grants of patents to British subjects, actual residents of Canada, your Committee believe is impolitic, and leads to constant evasions of the laws of the Province, and consequent frequent litigations.

PROVINCIAL EXHIBITIONS.

In the early part of the year your Committee was invited by the Board of Arts and Manufactures for Lower Canada, to unite with them in holding a Provincial Exhibition in Montreal, on the occasion of the late visit of His Royal Highness the Prince of Wales. Your Committee felt compelled to decline the invitation thus given on the ground of the previous engagements of the executive officers of this Board, to assist in the management of the Provincial Association's Exhibition for Upper Canada, which was expected te take place in the City of Hamilton during the Prince's visit to that city. Had it not been for these prior engagements, and the claims of Upper Canada to their services, your committee would have been most happy to have assisted and co-operated with the sister Board of Lower Canada.

Your Committee have to acknowledge the receipt, from the Lower Canada Board, of a number of copies of the Catalogue of Articles shown, and Prizes Awarded, at the Exhibition just alluded to in the City of Montreal.

ESSAY ON MANUFACTURES.

Convinced of the importance of possessing a thorough knowledge of the manufacturing capabilities of the Province, and of the several branches of manufactures which it would be most profitable for us to engage in, your Committee have offered a First Prize of $150, and a Second Prize of $75, for the 1st and 2nd best essays on "The Manufactures which are most suited to the circumstances and capabilities of Upper Canada;" the essays to be enclosed to the Secretary of the Board not later than the first day of July next.

Full particulars of what is required to be treated of in these essays, is contained in the pages of the January number of the Journal.

BOARD ROOMS.

Your Committee have made arrangements for leasing a suite of rooms for the purposes of the Board, in the new hall of the Toronto Mechanics' Institute, which are expected to be ready about the first of April next.

All which is respectfully submitted.

WM. EDWARDS, *Secretary.* JOHN BEATTY, JR., *President.*

Members of Mechanics' Institutes, and of other public bodies, subscribing for this Journal throug their respective Societies, will have their copies addressed to them direct from the Office of the Board.

The free Library of Reference, and Model Rooms, are open to the public daily, from 10 a.m. till noon, and from 1 to 4 o'clock, p.m., at the Board Room, No. 79 King Street West, Toronto.

The regular meetings of the Sub-Committee of the Board are held on the last Thursday of each month.

EDITORIAL NOTICES.

DR. LILLIE'S LECTURE.

On another page will be found an admirable lecture, by the Rev. Dr. Lillie, on "BOOKS; THE KIND TO READ, AND THE WAY TO READ THEM." Manu-

script copies of this lecture have been sent by the Board to several Mechanics' Institutes, where it has been read at one of the ordinary meetings of those Institutions. The publication of Dr. Lillie's Lecture will ensure it a more extended circulation, and thus bring it within the reach of many who would not otherwise have had an opportunity of hearing or reading it.

INTERNATIONAL EXHIBITION OF 1862.

All preliminaries for this exhibition are satisfactorily completed. Her Majesty's commissioners for the exhibition for 1851 accept the same trust in relation to the approaching exhibition as they filled with so much honour and success ten years ago. The commissioners are Earl Granville, the Marquis of Chandos, Mr. Thomas Baring, Mr. C. Wentworth Dilke, and Mr. Thomas Fairbairn.

The guarantee list includes 662 persons, and the sum guaranteed now amounts to £366,800.

The commissioners for the exhibition of 1851 have granted a site for the building on their estate at South Kensington.

DUNDAS MECHANICS' INSTITUTE.

ABSTRACT OF ANNUAL REPORT.

To the President and Members of the Dundas Mechanics' Institute and Library Association.

The Auditors beg leave to present the following Report for the year, to Dec. 31st. 1860:

They find that the number of paying members are about 50; average number of readers, 20; the number of volumes added to the library for 1860, 90; the number of monthly magazines and quarterly reviews 64; the above at a cost of $68 45.

Dr.	
As shown by the Treasurer's Report and Librarian's Books, the total disbursments for the year were	$159 25
Cr.	
By credit to Institute in Treasurer's hands.	$165 07
By cash collected by Librarian	66 18
By orders on Treasurer	69 30
	$300 55
	159 25
Balance in favour after paying debts	$141 30

The auditors further consider that the sum of $45 is now due and available from members, which, when collected and placed in the Treasurer's hands, there will be then in our favour $186 30.

The Institute is now in good working order, and the members may congratulate themselves that their Institute is not in debt, but own property, in books and apparatus, to the amount of $1400, unincumbered, and is insured to the amount of $1000.

All of which is respectfully submitted.

THOMAS SHELDRICK, GEORE BICKELL, } *Auditors.*

The following gentlemen were elected office-bearers for the ensuing year:—

Thomas Sheldrick, President; William Roberts. Vice-President; A. D. Calder, Secretary; J. M. Babington, Treasurer; Geo. Bickell, Librarian; Duncan McMillan, Assistant Librarian.

DIRECTORS:—David Anderson, R. McKechnie, Senr., James Somerville, William McDonald, Senr., William McDonald, Junr., John McGachie, R. McKechnie, Junr., John Anderson.

Messrs. George Bickell and Roberts were chosen delegates to the Board of Arts.

SOCIETY FOR THE ACCLIMATISATION OF ANIMALS.

This is the name of a society recently established in England, for various objects which are enumerated in the subjoined paragraphs. The secretary is Mr. F. T. Buckland, M.A., Assistant Surgeon, Second Life Guards. The society has already received a munificent donation of £500 stg., from Miss Burdett Coutts, together with a promise of an annual subscription of £10 for five years.*

The purposes of the Society are—

1. The introduction, acclimatisation, and domestication of all innoxious animals, birds, fishes, insects and vegetables, whether useful or ornamental.
2. The perfection, propagation, and *hybridisation* of races newly introduced or already domesticated.
3. The spread of indigenous animals, &c., from parts of the United Kingdom where they are already known, to other localities where they are not known.
4. The procuration, whether by purchase, gift, or exchange, of animals, &c., from British and foreign countries.
5. The transmission of animals, &c., from England to her colonies and foreign parts, in exchange for others sent thence to the society.
6. The holding of periodical meetings, and the publication of reports and transactions for the purpose of spreading knowledge of acclimatisation, and inquiry into the causes of success or failure.

The society will begin with small and carefully conducted experiments.

It is proposed that those members who happen to have facilities on their estates for experiments, and who are willing to aid the objects of the society, should undertake the charge of such subjects for experiments as may be offered to them by the society, periodically reporting progress to the council.

It will be the endeavour of the society to attempt to acclimatise and cultivate those animals, birds, &c., which will be useful and suitable to the park, the moorland, the plain, the woodland, the farm, the poultry-yard, as well as those which will increase

* See an admirable paper, "On the Acclimatisation of Animals," by F. T. Buckland, M. A., Assistant Surgeon, Second Life Guards, in the Journal of the Society of Arts, Nov. 30th, 1860.

the resources of our sea-shores, rivers, ponds, and gardens.

It is hoped that this endeavour to increase the internal resources of the country will meet with the support of the public.

Persons desirous of becoming members may do so on subscribing £2 2s. per annum. A donation of £10 will make the donor a life member of the society.*

The animals to which the society intend first to direct their attention, are:

1. A small sheep, one from Brittany.

2. The prairie grouse, prairie hen, or pinnated grouse, and the tree grouse of America.

3. The "Lucid Perca," or the Sander, which it is desired to transform into a useful pond fish.

As this society becomes more widely known, it will receive great support from the British Colonies, and it certainly appears both feasible and desirable that branch societies should be established in British America, and elsewhere with a view to collect and transmit to England such animals as are worthy of attention and trial.

* Temporary offices, 346, Strand.

MANUFACTURING INDUSTRY IN FOREIGN COUNTRIES.

This number of the Journal contains the first of a series of articles on the manufacturing industry of foreign countries. The information is derived chiefly from the "Reports by Her Majesty's Secretaries of Embassy and Legation on the Manufactures, Commerce, &c., of the countries in which they reside." In order to render the description as complete as it compatible with the space which can be devoted to this subject, various facts relating to the population, climate, and natural productions, will be introduced when such information is likely to be of advantage to Canadian readers.

PATENTS OF CANADA FROM 1824 TO 1849.

A handsome royal octavo volume, bearing the above title, has just been issued from the Bureau of Agriculture and Statistics. In the introduction it is stated, that the business of the patent office in Canada has so greatly increased during the last few years, that the government has deemed it advisable to follow the example of other countries, and to publish from time to time the specifications and drawings of all patents issued in the province.

The present volume contains the specifications of patents issued in both provinces, before and after the union, from the year 1824, to January, 1844; and of the specifications and drawings from January, 1844 to May 1849. The drawings of those inventions the patent right of which expired in January, 1858, have not been given, as they are now the property of the public.

It is sufficient to say of this volume, that it is one of the best printed public documents which has yet appeared in Canada; the type is large, the paper good, and the general arrangement admirable. The model after which this very superior work has been got up, is that of the Patent Office Reports of the United Kingdom, than which nothing better can be desired. The contents of the volume are of interest and importance, first, as records; secondly, as a work of reference; but it is not probable that Canadian patents dating so far back as from 1824 to 1849, will possess much practical value at the present day, considering the marvellous strides which have taken place during ten or fifteen years in all branches of mechanical industry, and in the introduction of new processes which have originated from the progress of science and art. The next volume will possess greater interest, bringing us more within our own times. If liberally and judicially distributed, there can be no doubt that the "PATENTS OF CANADA" will exercise a very valuable and encouraging influence throughout the country, as soon as they come within the reach of the manufacturers and mechanics of the Province.

PRIZES FOR THE MANUFACTURE OF PAPER.

Among the list of prizes offered for public competition (open to all Nations) by the Industrial Society of Mulhouse, France, and which are awarded at its general meeting in May, 1861, are the following on the

MANUFACTURE OF PAPER.

1. For importing into France a filamentous substance in the state of half-stuff, which may be applied to the manufacture of paper—*Gold medal and a premium of* £160.

2. For the best treatise on decolorizing and bleaching rags—*Gold medal worth* £20.

3. For introducing into commerce 500 kils. [about 1,000 lbs.] at least of paper, having all the qualities required for photographic purposes—*Silver medal.*

The papers are to be sent in before the 16th February, 1861.

Correspondence.

"VICTORIA OIL."

The permission to make use of the following reply to a letter of enquiry, addressed to the secretary of the Canada Oil Company, Hamilton, is embraced with pleasure, and the prompt and courteous attention it shows, cordially acknowledged.

To the Editor of the Journal of the Board of Arts and Manufactures.

Hamilton, Jan. 7th, 1861.

Dear Sir :—Your letter of the 1st was duly received. We will endeavour to answer the majority of the questions you propose; others of them we will only touch upon, as their full answers would involve the imparting to the public of information which has cost our company several thousands of dollars to obtain, and the giving of publicity to which might result in serious injury to ourselves. The crude material from which we manufacture our "Victoria Oil" is obtained in the Township of Enniskillen, County of Lambton, from wells sunk to depths, averaging, say forty feet through a white clay to the rock, the fissures in which form a natural outlet for the oil into these wells. As to the source of supply we have no available or satisfactory information. About 100,000 gallons have been taken from two of our wells, during the last eighteen months by means of a common hand pump. With the oil comes a large quantity of water, say one half, sometimes much more. We are now trying a steam pump with a view of testing the full capacity of our springs.

With regard to the mode of purifying, we would simply remark, that it is done by means of distillations, and the application of acids and other substances. We do our manufacturing entirely at this place. The first and largest portion which comes over on distillation, is treated for burning oil and has a specific gravity of 40 Beaumè. The balance of the distillate is much more dense, containing a larger per centage of parafine, and is used for lubricating and other purposes. The refuse being about five per cent, is a coke, remaining in the still, rich in carbon, burns freely in a grate, making a good fuel. The loss in manufacturing consists in carburetted and sulphuretted hydrogen, and other gases formed and liberated during the process, and varying from one to five per cent., according to the rapidity with which the vapours are driven off. Numerous other parties are digging and boring for oil in the Western Counties with anticipations of great success. They have obtained several thousands of gallons of oil. What will be the result from the application of steam, time will determine. If you think any of the above information is of service, you are at liberty to use it as you see fit.

Respectfully yours,
W. P. Fisher, *Sec. C. O. Co.*

AMMONIA FROM BONES.

Our Correspondent P. R. L. asks whether there is a market for the ammonia which could be collected in the manufacture of animal charcoal; the price; the state in which it is sold; the purposes for which it is used; and the best means of preparing and collecting it for the market. In reply we state that, in Britain, ammonia is not manufactured largely from bones, but it is produced to a great extent from the ammoniacal liquor of the gas works. In France, where bone black or animal charcoal is employed to a very considerable extent in refining syrups, ammonia as a by-product is an important branch of manufacture. The condensed vapours from the retort in which the bones are calcined contain much carbonate of ammonia, water, and oil. The greater portion of the oil can be separated by decantation; the carbonate of ammonia can be fixed and collected by converting it into sal ammoniac by the addition of muriatic acid to saturation, and then evaporating the solution in a leaden boiler until a skin or pellicle appears; it may then be run off into tubs to crystallize and the crystals drained. As crude sal ammoniac it will find a sale, and it is in this state that it may be brought into the market; but the carbonate of ammonia, made by distilling the sal ammoniac with lime, is the most profitable compound. Sal ammoniac is largely used in tinning cast iron, copper and brass, and for pharmaceutical preparations. Sulphate of ammonia, made chiefly from the gas liquor, is worth $60 a ton in England, and is used as a fertilizer.

Selected Articles.

METALLURGY OF IRON.

By T. Slerry Hunt, Esq., Chemist and Mineralogist to the Geological Survey.*

The new metallurgical processes of Adrien Chenot attracted in a particular manner the attention of the Jury at the Palace of Industry, and were the object of a special study by the 1st class, who awarded to the inventor the *Gold Medal of Honour.* M. Chenot there exhibited a series of specimens serving to illustrate the processes which bear his name, and which have been the result of extraordinary labors on his part, continued through the last twenty-five years. As the industry of iron smelting promises for the future to be one of great importance to Canada, it may be well to advert briefly to the history and theory of the metallurgy of iron, in order to explain the processes now in use, and to prepare the way for an exact understanding of those of Chenot.

The most ancient and simplest mode of obtaining iron from its ores is that practised in the Corsican and Catalan forges, where pure ores are treated with charcoal in small furnaces, and by variations in the mode of conducting the process, are made to yield at once malleable iron, or a kind of steel. But this method requires very pure ores, and a large expenditure of fuel and labor; while from the small size of the furnaces it yields but a limited quantity of iron. It is scarcely used except in the Pyrennees, Corsica, some parts of Germany, and northern part of the State of New York.

The high or blast furnace, which converts the ore directly into cast metal, furnishes by far the greater part of the iron of commerce. This furnace may be described as consisting essentially of a crucible in which the materials are melted, surmounted by a vertical tube or chimney some thirty feet in height, in which the reduction of the ore is effected. Into this furnace a mixture of ore and fuel is introduced from the top, and the fire, once kindled, is kept up by a blast of hot or cold air, supplied by a proper apparatus, and admitted near the bottom of the furnace. The ores submitted to

* Geological Survey of Canada; Report for 1855.

this process are essentially combinations of iron with oxygen, often containing besides water and carbonic acid, and always mingled with more or less earthy matter, consisting of silica, alumina, &c. The water and carbonic acid being readily volatile, are often expelled by a previous process of roasting. When these oxyds of iron are heated to redness in contact with charcoal, this material combines with the oxygen of the ore, and the iron is set free or reduced to the metallic state, after which, by the further action of the combustible, it is fused, and collects in a liquid mass in the crucible below. The earthy ingredients of the ore, with the ashes of the fuel, are also melted by the intense heat, and form a glassy substance or *slag*, which floats upon the surface of the molten metal, and from time to time both of these are drawn off from the crucible. It is very important to give to these earthy substances that degree of fluidity which shall permit their ready separation from the reduced and melted iron, and to attain this end the different ores are generally mixed with certain ingredients termed fluxes, which serve to augment the fusibility of the slags. Limestone, sand and clay may each of them be used for this object with different ores. It will be kept in mind that the fuel employed in the process of smelting serves for two distinct objects: first, as a combustible to heat the materials; and, secondly, as a reducing agent to remove the oxygen from the ore.

The contents of a blast furnace in action consist then of a great column of mingled ore and fuel, continually moving downward towards the crucible, and constantly replenished from the top, while a current of air and gases is constantly traversing the mass in a contrary direction. The investigations by Leplay and Ebelman of the theory of this operation have prepared the way for the processes of Chenot, and we shall therefore state in a few words the results of their researches. They have shewn, in the first place, that the direct agent in the reduction of the ore is a portion of the carbon of the fuel in a gaseous state; and secondly, that this reduction is effected at a temperature far below that required for the fusion of the metal. The oxygen of the air, entering by the blast, is at first converted by combination with the ignited coal into carbonic acid, in which an atom of carbon is combined with two atoms of oxygen; but as this gas rising in the furnace encounters other portions of ignited coal, it takes up another equivalent of carbon, and forms carbonic oxyd gas, in which the two atoms of oxygen are combined with two of carbon. This gas is the reducing agent; for when in its upward progress it meets with the ignited oxyd of iron, the second atom of carbon in the gas takes from the iron two atoms of oxygen to form a new portion of carbonic acid, which passes on, while metallic iron remains.

The interior of the blast furnace may be divided into four distinct regions: the first and uppermost is that in which the mixture of ore and fuel is roasted; the water and volatile matters are there driven off, and the whole is gradually heated to redness. In the second region, immediately below the last, the already ignited ore is reduced to the metallic state by the ascending current of carbonic oxyd gas; the metal thus produced is, however, in the condition of malleable iron, nearly pure, and very difficultly fusible; but in the third region it combines with a portion of carbon, and is converted into the fusible compound known as cast iron. In addition to this, small portions of magnesium, aluminium and silicium, whose combinations are always present in the contents of the furnace, become reduced, and alloying with the iron affect very much its quality for better or worse. Cast iron generally contains besides these small portions of sulphur, phosphorus, and other impurities less important.

In the fourth and lowest region of the furnace, which is near to the blast, the heat becomes more intense, the carburetted metal melts, together with the earthy matters, and both collect at the bottom of the crucible upon what is called the earth, from which the two are drawn off from time to time. The cast iron thus obtained is very fusible, but brittle, and is far from possessing those precious qualities which belong to maleable iron or steel.

To convert the cast metal into malleable iron, it is exposed to a process called *puddling*, and consists essentially in fusing it in a furnace of a peculiar kind, where the metal is exposed to the action of the air. The carbon, manganese, silicium, and other foreign matters, are thus burned away, and the once liquid metal is converted into a pasty, granular mass, which is then consolidated under hammers or rollers, and drawn out into bars of soft malleable iron.

To convert into steel the soft iron thus obtained, it is heated for a long time in close vessels with powdered charcoal, a small quantity of which is absorbed by the iron, and penetrating through the mass changes it into steel. This process is known by the name of *cementation*. The change is, however, irregular and imperfect: it is therefore necessary to break up these bars of cemented or blistered steel, as it is called, and after assorting them according to their quality, either to weld them together, or to melt down each sort by itself in large crucibles. The metal is then made into ingots, and forms cast steel, which is afterwards wrought under the hammer and drawn out into bars.

Such is an outline of the long and expensive processes by which malleable iron and steel are obtained from the ores of iron. The reduction of the iron to the metallic state constitutes but a small part of the operation, and consumes comparatively but little fuel; but as we have already seen that reduced iron is first carburetted as it descends in the furnace, then melted by an intense heat into the form of cast iron, which is again fused in the puddling furnace before being converted into malleable iron, the transformation of which into cast steel requires a long continued heat for the cementation, and still another fusion.

In Derbyshire, in England, there are consumed for the fabrication of one ton of cast iron, two tons and twelve quintals of ore, and two tons of mineral coal; while in Staffordshire, two tons eight quintals of coal, and two tons seven quintals of ore are required for the production of one ton of cast metal. In the furnaces of the Department of the Dordogne, in France, where wood charcoal is employed, two tons and seven quintals of ore, and one ton and three quintals of charcoal are employed for a ton of iron. For the production of a ton of wrought iron in England, about one ton and one-third of cast iron, and from two to two and a-half tons of mineral coal are consumed; while the same amount of the cast iron of the Dordogne requires to convert it into a ton of wrought iron, one ton and a-half of charcoal. Thus in England the fabrication of a ton of wrought iron, from poor ores yielding from thirty-eight to forty per cent. of metal, requires a consumption of about five tons of mineral coal, and in Dordogne little over three tons of wood charcoal, which costs there about fifty-eight shillings currency the ton. The average price of charcoal in France, however, according to Dufrénoy, is about seventy-four shillings, while in Sweden it costs only about fourteen shillings, and in the Ural mountains eleven shillings the ton. In France much of the pig iron manufactured with charcoal is refined by the aid of mineral coal.

The questions of the price and the facility of obtaining fuel are of the first importance in the manufacture of iron. The ores of this metal are very generally diffused in the earth's surface, and occur abundantly in a

great many places where fuel is dear. The iron which is manufactured either wholly or in part with wood charcoal, is of a quality much superior to that obtained with mineral coal, and commands a higher price. One principal reason of this difference is that the impurities present in the coal contaminate the iron, but it is also true that the ores treated with mineral coal are for the greater part of inferior quality. Interstratified with the beds of coal in many parts of Great Britain, Europe and North America there are found beds of what is called *clay iron stone*, or argillaceous carbonate of iron, yielding from twenty to thirty-five per cent. of the metal. This association of coal with the ore offers great facilities for the fabrication of iron, which is made in large quantities, and at very low prices from these argillaceous ores.

These poor ores will not admit of being carried far for the purpose of smelting, and it is not less evident that the large quantity of coal required for their treatment could not be brought from any great distance to the ores. As a general rule the richest and purest ores of iron belong to regions in which mineral coal is wanting, while the carboniferous districts yield only poorer and inferior ores. On this continent, which contains vast areas of coal-bearing rocks, the great deposits of magnetic and hematitic iron ores are chiefly contained in the mountainous district north of the St. Lawrence, and the adjacent region of northern New York, to which may be added a similar tract of country in Missouri. In the old world it is in Sweden, the Ural mountains, Elba, and Algiers that the most remarkable deposits of similar ores are met with; and it is not, perhaps, too much to say, that if favourable conditions of fuel and labor were to be met with in these regions, these purer and more productive ores would be wrought to the exclusion of all others. But obliged to have recourse to wood charcoal the forests in the vicinity of large iron furnaces are rapidly destroyed, and fuel at length becomes scarce. In a country like ours where there is a ready market for fire-wood near to the deposits of ore the price of fuel will one day become such as to preclude the possibility of their economic working by the ordinary processes. As the industrial arts progress the consumption of fuel is constantly increasing, and its economical employ becomes an important consideration.

From these preliminaries it is evident that a great problem with regard to the manufacture of iron, is to find a process which shall enable us to work with a small amount of fuel those rich ores which occur in districts remote from mineral coal. Such was the problem proposed by Adrien Chenot, and which, in the opinion of the International Jury, he has in a great measure resolved.

To return to the blast furnace. We have seen that the second and moderately heated region is that in which the reduction of the ore is effected, and that the intense heat of the lower regions of the furnace only affects the carburation and fusion of the metal. M. Chenot conceived the idea of a furnace which should consist only of the roasting and reducing regions: his apparatus is but the upper portion of an ordinary blast furnace; the carburetting and fusing regions being dispensed with. In this the ore is reduced at a low red heat, and the metal obtained in the form of a grey, soft, porous mass, constituting a veritable metallic sponge, and resembling spongy platinum. The furnace of Chenot is a vertical prismatic structure, forty feet high, open at the top for the reception of the ore, and having below a moveable grate by which the charge can be removed—the bottom is susceptible of being closed air tight. The lower part of the furnace is of iron plate, and is kept cool, but about midway the heat is supplied for the reduction of the ore;—and here comes in an important principle, which will require a particular explanation. It is required to heat to moderate redness the entire surface of the rectangular vertical furnace throughout a length of several feet; a result by no means easy to be effected by the use of a solid combustible, but readily attained by a gaseous fuel such as is employed by M. Chenot.

We have already explained the theory of the production of carbonic oxyd. The possibility of employing this gas as a combustible was first suggested by Karsten, and in 1841 M. Ebelman, of the School of Mines at Paris, made a series of experiments on the subject, by the direction of the Minister of Public Works. The process employed by this chemist consisted essentially in forcing a current of air through a mass of coal of such thickness that the whole of the oxygen was converted into carbonic oxyd; this escaping at an elevated temperature was brought into contact with the outer air, and furnished by its combustion a heat sufficient for all the ordinary operations of metallurgy. A consideration of great importance connected with this process is, that it permits the use of poor, earthy coals, and other waste combustibles, which could hardly be employed directly, while by this method the whole of their carbonaceous matter is converted into inflammable gas. Wood and turf may be made use of in the same way, and the gas thus obtained will be mingled with a portion of hydrogen, and probably with some hydrocarburet: a similar mixture may be obtained with charcoal or anthracite, if a jet of steam be introduced into the generating furnace—a modification of the process, which has, however, the effect of reducing the temperature of the evolved gases.

This mode of employing combustibles becomes of great importance in the process of Chenot, who generates the gas in small furnaces placed around the great prismatic tube, and conducts it into a narrow space between this and an outer wall; through this, by openings, a regular supply of air is introduced for the combustion of the gas, by which the ore contained in the tube is raised to a red heat. The next step is to provide the reducing material which shall remove the oxygen from the ignited ore, and for this purpose, we have already seen, that even in the ordinary smelting process carbonic oxyd is always the agent; but instead of the impure gas obtained from his furnaces, and diluted with the nitrogen of the air, M. Chenot prefers to prepare a pure gas, which he obtains as follows. A small quantity of pure carbonic acid, evolved from the decomposition of carbonate of lime, is passed over ignited charcoal, and thus converted into double its volume of carbonic oxyd gas; this is then brought into contact with ignited oxyd of iron, which is reduced to the metallic state, while the gas is changed into carbonic acid, ready to be coverted into carbonic oxyd by charcoal as before. In this way the volume goes on doubling each time the two-fold operation is repeated. By introducing the carbonic oxyd thus obtained into the furnace charged with ignited iron ore, and withdrawing a portion of the gas at a higher level, for the purpose of passing it again over ignited charcoal in a smaller tube apart, the process may be carried on indefinitely; the carbonic acid serving as it were to carry the reducing combustible from the one tube to the ore in the other.

A modifieation of this process consists in mingling the ore with an equal volume of small fragments of charcoal, and admitting a limited supply of air into the body of the apparatus, by openings at mid-height, the heat being, as before, applied from without. In this case the action is analagous to that which takes place in the ordinary blast furnace: carbonic oxyd and carbonic acid are alternately formed by the reactions between the oxygen of the air, the ore and the charcoal; but the supply of air being limited, and the tem-

perature low, neither carburation nor fusion of the metal can take place, and five-sixths of the charcoal employed remain unchanged, and serve for another operation. This simpler way has the disadvantage that one-half of the furnace is occupied with charcoal, so that the product of metal is less than when the reducing gas is prepared in a separate generator. In either case the product is the same, and the iron remains as a soft, porous substance, retaining the form and size of the original masses of ore. This metallic sponge is readily oxydized by moisture, and if prepared at a very low temperature, takes fire from a lighted taper, and burns like tinder, yielding red oxyd of iron. In order to avoid the inconvenience of this excessive tendency to oxydation, the metal is exposed in the process of manufacture to a heat somewhat greater than would be required for the reduction: this renders the sponge more dense, and less liable to oxydation in the air.

The part of the furnace below the action of the fire is so prolonged, that the reduced metal in its slow descent has time to become very nearly cold before reaching the bottom. It is then removed at intervals, by an ingenious arrangement, which enables the operator to cut off, as it were, the lower portion of the mass, without allowing the air to enter into the apparatus. In the case where the ore has been mixed with charcoal, the larger masses of metal are now separated from it by a screen, and the smaller by a revolving magnetic machine.

This spongy metallic iron may be applied to various uses. If we grind it to powder, and then submit it to strong pressure, coherent masses are obtained, which, at a welding heat, contract slightly, without losing their form, and yield malleable iron. By this process of moulding — which may be termed a casting without fusion—the metal may be obtained in forms retaining all the sharpness of the mould, and possessing the tenacity, malleability and infusibility of wrought iron. The masses thus compressed have in fact only to be forged to give wrought iron of the finest quality; and it is found that during the hammering any earthy matters mechanically intermixed are eliminated like the scoriæ of the iron from the puddling furnace.

But without overlooking the great advantage of this method of making malleable iron, and moulding it into the shapes required, it is especially as applied to the manufacture of steel that the metallurgical methods of Chenot deserve attention. In the ordinary process, as we have already seen, the bars of malleable iron are carburetted by a prolonged heating in the midst of charcoal powder; but the operation is long and expensive, and the metal obtained by this mode of cementation is not homogeneous. M. Chenot avails himself of the porosity of the metallic sponge to bring the carbon in a liquid state into contact with the minutest particles of the iron. For this purpose he plunges the sponge into a bath of oil, tar or melted resin, the composition of the bath varying according to the quality of the steel which it is desired to obtain. The sponge thus saturated is drained, and heated in a close vessel. The oily or resinous matter is expelled partly as a gas, but for the greater part distils over as a liquid, which may again be employed for cementation. A small portion of the carbon from the decomposition of the oil rests, however, with the iron, and at the temperature of low redness, employed near the end of distillation, appears to have already combined chemically with the metal. This treatment with the bath and distillation may be renewed if the carbonization is not sufficient after one operation.

The cemented sponge is now ground to powder, and and moulded by hydraulic pressure into small ingots, which may be heated and directly wrought under the hammer, like the compressed iron sponge;—the metal thus prepared may be compared to refined blistered steel. If, however, the cemented and compressed sponge is fused in crucibles, as in the ordinary process for making cast steel, the whole of the earthy impurities which may be present rise to the surface as a liquid slag, which is easily removed, while the fused metal is cast into ingots. In this way, by cementation and a single fusion, the iron sponge is converted into a cast steel, which is, from the mode of its preparation, more uniform in quality than that obtained by the ordinary process, and which was found by the Jury to be of remarkable excellence.

Such is a brief outline of the methods invented by Adrien Chenot for the reduction of iron ores, and the fabrication of wrought iron and steel, constituting, in opinion of one eminently fitted to judge the case, (M. Leplay, of the Imperial School of Mines, and Commissary General of the Exhibition), the most important metallurgical discovery of the age.

The peculiar condition of the iron sponge has enabled the inventor to make many curious alloys, some of which promise to be of great importance; by impregnating it with a solution of boracic acid, a peculiar steel is obtained, in which boron replaces carbon, and by a similar application of different metallic solutions, various alloys are produced, whose formation would otherwise be impossible.

The processes of M. Chenot are now being applied to the fabrication of steel, at Clichy, near Paris, where I had an opportunity of studying in detail the manufacture. The iron ore is imported from Spain, and notwithstanding the cost of its transport, and the high prices of labor and fuel in the vicinity of the metropolis, it appears from the data furnished by M. Chenot to the Jury, that steel is manufactured by him at Clichy, at a cost which is not more than one-fourth that of the steel manufactured in the same vicinity from the iron imported from Sweden. According to M. Chenot, at the works lately established on his system by Villalonga & Co., near Bilboa in Spain, they are enabled to fabricate the metallic sponge at a cost of 200 francs the ton, and the best quality of cast steel at 500 francs, or $100 the ton of 1000 kilogrammes, (2·200 pounds avoirdupois.) The conversion of the ore to the condition of sponge is, I was assured by M. Chenot, effected with little more than its own weight of charcoal.

The differences in the nature of the steel made from various ores have long been well known, but until the recent experiments of Chenot, the subject was but very imperfectly understood. According to him, the nature of the ore has much more to do with the quality of the metal than the mode of treatment, and he compares the different steels to the wines of different localities, which owe their varied qualities far more to the nature of the grapes, than to any variations in the mode of their fermentation. The process of cementation employed by Chenot furnishes, according to him, an exact measure of the capability of the iron to produce steel. The sponges of the iron from Sweden and the Ural Mountains, after taking up six per cent. of carbon, yield a metal which is still malleable, while that of Elba with four per cent., becomes brittle and approaches to cast iron in its properties. While the ores of Sweden and the Urals are famous for the excellent quality of their steel, the ore of Elba is known to yield a very superior iron, but to be unfit for the fabrication of steel; and Chenot concludes, from a great many observations, that the steel-producing capacity of any iron is measured by the quantity of carbon which it can absorb before losing its malleability and degenerating into cast iron.

Desirous to avail myself of these researches of M. Chenot, I placed in his hands, in September, 1855, specimens of the different iron ores from Canada, which had been sent to the Exhibition at Paris, and engaged

him to submit them to the process of reduction, and to test their capabilities for the production of steel. M. Chenot has also obtained remarkable alloys of chromium and titanium with iron, his processes enabling him to effect the direct reduction of chromic and titaniferous iron ores; specimens of these two ores from Canada were therefore furnished him, but the sudden and lamented death of Chenot, by an accident, in the month of November following, deprives us for a time of the advantages of his experiments. His sons however are instructed in his processes, and have promised to undertake at an early day the examination of our Canadian ores. I am disposed to attach great importance to these investigations, from the hope that among our numerous deposits of iron ire, belonging in great part to the same geological formation as the iron ores of Scandanavia, there may be found some capable of yielding a steel equal to that of the Swedish iron. With the new and economical processes of Chenot a valuable steel ore will be sought for, even in a distant country, and may be advantageously transported in a crude state, to the localities where fuel and labour are most available.

One great condition for the successful application of these processes is, that the ores should be comparatively pure and free from earthy mixtures. We have already alluded to the impurity of the ores which are smelted in the coal districts of England, and even the ore brought by Chenot from Spain, and employed by him in his works at the gates of Paris, contains about ten per cent. of fixed, and as much volatile matter, it being a decomposed spathic iron. Many of the magnetic and hematite ores of Canada are almost chemically pure: such are those of Marmora, Madoc, Hull, Crosby, Sherbrooke, MacNab and Lake Nipissing, which even if they should not prove adapted to the manufacture of superior steel, offer for the fabrication of metallic iron, by the processes of Chenot, very great advantages over the poorer ores, which in many parts of this continent are wrought by the ordinary processes.

The small amount of fuel required by the new methods, and the fact that for the generation of the gas which is employed as combustible, turf and other cheap fuels are equally available, are considerations which should fix the attention of those interested in developing the resources of the country. With the advantages offered by these new modes of fabrication, our vast deposits of iron ore, unrivalled in richness and extent, may become sources of national wealth, while by the ordinary method of working they can scarcely, at the present prices of iron and of labour, compete with the produce of such poorer ores, wrought in the vicinity of deposits of mineral coal.

NEW INDUSTRIAL PROCESSES.

ON ELECTRO-BLOCK PRINTING,

ESPECIALLY AS APPLIED TO ENLARGING OR REDUCING ANY PRINTING SURFACE OR ORIGINAL DRAWING.

By H. G. Collins.

Abreviated from the Journal of the Society of Arts.

ENLARGING OR REDUCING PROCESS.

I take my subject, which may be a printing surface of any description, either a wood cut, a steel or copper-plate engraving, a stereotype or electrotype block, or a lithographic stone, and in fact any surface capable of giving off an impression; and then on a sheet of vulcanised india-rubber, covered with a composition possessing equal elasticity, and of a non porous character, I take the impression in transfer ink; if from stone, at the lithographic press; if from steel or copper-plate at the copper-plate press, and if from surface-block or type, at the type press. I then punch small holes at equal distances (generally half an inch) round the rubber, into all of which I insert hooks of the same size. I connect them, by means of four bars passed through the body of these hooks, and thus the sheet is ready for the expanding machine. This consists of two parts, the table and the screw. The table is composed of slate, perfectly even, and mathematically true; round it is a sort of raised shelf for the four bars before mentioned to rest upon, and divided into inches, half-inches, quarter inches, and eighths. I place the sheet of rubber, with the hooks and bars round it, square upon the frame, then take the screw, and after duly fixing it, I extend the rubber equally in all directions till it assumes the required size. I test the accuracy of the extension, from time to time during the operation, by measuring the distances between different marks printed on the sheet for that purpose when in an unextended state, and I adjust the tension until I find that the distances have all been increased in the same ratio. The impression on the rubber being thus enlarged, I transfer it to a prepared surface of stone or metal, which is then printed in the usual mode of litho or zincography. When the amount of extension required is greater than can be well obtained at one operation, which is generally limited to four times the area, it is only necessary to repeat the process.

For reducing—the operation is simply reversed. I extend the rubber first to the original size of the work to be reduced, then take the impression; after which I release the sheet from the tension, which then necessarily assumes its original dimensions; it is then put upon stone or metal, as before described, in the same manner as the enlarged subject, and printed in the usual way.

It is as well to mention that the indian-rubber, in order to extend equally, must be made of an uniform substance in every part, for the old axiom must here prove true, that the same thing, under the same circumstances, must always produce the same result; and it will be obvious that the slightest variation in this particular would materially detract from the perfection of the process; for if any portion should be thinner than the general character of the sheet, that portion must of necessity possess greater yielding power than the remainder, and thus produce an inequality, and a consequent error in its mathematical proportions, and although this slight difference might not signify for ordinary work, such as landscapes, or general illustrations, it would totally preclude the adoption of my invention for maps and plans, or any matter where accurate scales would be indispensable. This perfection in the rubber has not been obtained without great cost of anxiety, time, and money, as in my first steps I was not sufficiently acquainted with the wonderful mysteries of its nature, and consequently was unable to furnish the manufacturers with all the conditions required, the knowledge of which has only been obtained from pure experiment and closely calculated results; and I am happy to say that at length all these difficulties have through the kindness and assistance of the various india-rubber Houses, especially Messrs. Silver, of Silvertown, been entirely surmounted.

With respect to the composition with which I coat the face of the sheet, I may mention, that without it the rubber would not give off the impression to the stone; in fact, the ink would be entirely absorbed; it is simply a transfer surface, involving the one necessary condition of equal tension with the rubber, or it would crack when extended, and destroy the picture. It is composed generally of flour, treacle, starch, white lead, and gelatine, and, when reduced to the consistency of cream, is applied with a brush, and allowed to become quite dry before being used.

ELECTRO-BLOCK PRINTING PROCESS.

This invention has for its object improvements in the production of blocks or surfaces to be used in printing. For these purposes, the drawing is obtained on a block or surface to be used in printing from a drawing, on a lithographic stone or other surface, whether the same has been produced thereon by hand, transferred or otherwise, by subjecting the drawing on the lithographic stone or other surface to a series of processes similar to that in which a lithographic stone is inked when about to be printed from in the ordinary way, but the ink or composition used is to be mixed with suitable dryers, so that each succeeding coating of the composition may quickly dry or set before the next coating is applied. By these means the lines and parts constituting the drawing on the stone or other surface, which would be inked and printed from it used in the ordinary manner, become more and more built up or raised; and when such raising has been sufficiently accomplished, a cast in wax or other suitable material is taken, from which an electrotype is obtained, as is well understood.

I do not, however, confine myself to this method; much depends on the character and quality of the work. In many cases, after obtaining the transfer on stone or zinc, instead of building up the picture by successive rollings, I eat away the surrounding part by acid, taking care that the transfer is made in ink, that will resist the action of acid and the galvanic battery, or that it be rolled up with a varnish possessing the same qualities. For fine work this second method is much more satisfactory.

From these two patents have sprung several valuable adjuncts. The first, and perhaps most important, is the production of electrotype blocks from the artist's original drawing, without the aid of the engraver. I simply require the artist to make his sketch on transfer paper in transfer ink, or, if he prefer it, in transfer ink upon grained metal plate, and this, when delivered into my hands, I roll up with the acid-resisting composition, and then submit it to the process before described for making surface blocks from the lithographic stone.

I have also succeeded in making transfers on to stone from most old prints and typography, which may be enlarged or reduced to any size, and made generally into electrotype blocks.

Photography and many other valuable processes in connection with the illustrative art are now engaging my attention, and I have no doubt that in a short time I shall be able to produce an electrotype block from a photograph in the course of a few hours.

I fully contemplate, from a series of experiments upon which I have been engaged the last few weeks, shortly being able to take a photograph of any passing scene, and to make the same into a block, ready for press within six or eight hours; thus affording to the public the opportunity of being supplied with what may be termed really a daily illustrated newspaper; and it would not be any presumption to say that, as in times gone by, Sir Robert Peel was handed a newspaper before he left the "House" containing the whole of his speech, which had taken him four hours to deliver, so we shall by this new aid be able to furnish an illustrated newspaper containing a faithful delineation of any grand or imposing ceremony that may have taken place during the day.

Crary's Improved Brick-making Machine.

The *Scientific American*, for January 5th, contains a drawing and description of this important machine for manufacturing bricks from comparatively dry clay. In the description it is stated that, "in Crary's machine, while the pressure is one of the most powerful capable of being produced by mechanism, it is brought to bear on only a portion of the brick at a time, and the clay is crowded into the mould with a peculiar kneading motion, which fills the edges and corners of the mould in the most perfect manner conceivable; thus producing a brick which, in smoothness, hardness and strength, is greatly superior to those made by the ordinary wet moulding processes."

"This machine is the invention of a man who has been engaged for many years in the manufacture of brick on an extensive scale. Having a large contract for furnishing brick to be used in the construction of Fort Jefferson—the largest fortification in the United States, situated on the island of Tortugas, off the coast of Florida—he had one of these machines constructed, and has subjected it to a thorough test. He says that it will, when running quite slow enough, turn out 40,000 bricks per day, requiring about a ten-horse power engine to drive it; that in New York it takes seventy hands to set and burn 40,000 bricks per day; but that, with his machine, twenty hands will do the work. The brick, too, made by his machine, are smoother, better finished, and more solid than those made in the ordinary way; they have been thoroughly tested in regard to strength and power of resisting pressure, by the engineers who have charge of Fort Jefferson, and found to be far superior in these respects to ordinary brick. But perhaps the most important feature in this machine is the facility which it gives of carrying on the manufacture of bricks in all weather. As the moulded forms require no drying, but may be placed at once in the kiln as they come from the machine, it is only necessary to provide a supply of clay under cheap sheds to keep the works in constant operation."

Iron deposited on Copper by Electrolysis.

At the Ordinary Meeting, October 2, 1860, of the Manchester Literary and Philosophical Society, the President brought under the notice of the meeting a sheet of copper, upon which, whilst under magnetic influence, *iron* had been deposited electrolytically. The experiment was made by Mr. F. H. Hobler, of London, as follows:—The plate of copper forming the bottom of a shallow vessel filled with a saturated solution of sulphate of iron, was placed on the poles of a powerful horse-shoe magnet, fixed vertically with its poles uppermost. An iron wire, dipping into the solution, was placed in connection with the positive electrode of a Daniell's cell, of one pint capacity, the copper plate being connected with the negative electrode. The deposited iron exhibited the lines of magnetic force in the same manner as in the case of iron filings scattered on a sheet of paper placed over a magnet.

The President also exhibited a slip of paper which he had received from Professor Thomson. On the paper was printed by photography the line indicating the various changes of atmospheric electricity, which took place at the Observatory of Kew during twelve successive hours. Much interest was excited by witnessing one of the first-fruits of Professor Thomson's beautiful instrument. The paper indicated a series of very rapid oscillations, about one per minute, of the intensity of atmospheric electrical force.

Bleaching of Sugar by Sulphurous Acid.

This has been often attempted, but without success; for when sulphurous acid is employed to bleach sugar solutions, the sulphurous acid thereby formed destroys a great amount of sugar, transforming it into non-crys-

talizable or liquid sugar. The same takes place when chorine is used even in minute quantities, and upon solid brown sugar or molasses. However, M. Moinier appears to have succeeded perfectly by conducting sulphurous acid vapours into a chamber containing brown sugar in the solid state. The bleaching progresses rapidly, and three-fourths of the colouring matter disappears without injuring the quality of the sugar, which only smells strongly of the acid, and may be immediately submitted to refining.

NOTICES OF BOOKS.

Autobiography of the Rev. Dr. Alexander Carlyle, Minister of Inveresk, containing Memorials of the Men and Events of his Time; Octavo, pp. 471. Boston: Ticknor & Fields. Toronto: Rollo & Adam, 1861.

Carlyle has so long been a name illustrious in history and in literature, that it is necessary to have some distinctive mark in order to recognise individuals whom it honours. The subject of this autobiography was born in 1722, and died in 1805, having during a long and busy life, exceeding four score years, mixed much with the prominent men of his times. The volume is full of very interesting, witty, and striking anecdotes, and brings the reader as it were in familiar contact with historical names, such as Simpson and Stewart, the mathematicians, Robert Dick, Prince Charles, Wilkes, Smollett, Thompson, Hume, Adam Smith, Adam Ferguson, John Blair, Garrick, Home, Archibald Duke of Argyle, Admiral Byng, Benjamin Franklin, Lord Clive, Ambassador Keith, and a host of others. It affords an excellent description of the state of society in different towns in England, towards the middle of the last century. As might be expected there is a tinge of national prejudice throughout, and in some cases the author is rather severe on the clergy of the Church of England, and patronising to John Bull, but on the whole it is a genial and pleasant work, and one which must be read with delight and probably with advantage by all.

Personal History of Lord Bacon, from unpublished papers, by William Hepworth Dixon, *of the Inner Temple;* Octavo, pp. 524. Boston: Ticknor & Fields. Toronto: Rollo & Adam, 1861.

There are not many men of any age or country whose reputation increases with the lapse of years. Bacon was among that illustrious few of whom the more we know, the more we desire to learn, however much in his case we may regret the weaknesses of his later life. At the age of nineteen this extraordinary man wrote a work, entitled "Of the state of Europe," which displayed remarkable industry and penetration. His *Organon* and *Novum Organum* were works of maturer years and remain as monuments of the genius and energy of one who laboured for posterity. "*The Personal History of Lord Bacon,*" reveals many of the secrets of the public and private life of him who has been designated the "Father of Experimental Philosoply." This book is written in a nervous and attractive style; the author is perhaps just touched with Hero-worship, but there is that in Francis Bacon which wins our warmest admiration, while we grieve over his shortcomings. Bacon took an active interest in the affairs of America during his time, and, as our author tells us, "a conspicuous part in the sacrifices, through which the foundations of Virginia and the Carolinas were first laid." Bacon in fact was one of the founders of the United States, yet no city is known by his name. To those who take an interest in biographical literature this volume will be a prize.

The American Journal of Science and Arts, Vol. XXXI. Second Series, January, 1861. New Haven.

This Journal was commenced in 1818, and has continued without interruption until the present time—a period of forty-two years. The first series was originally edited by Prof. B. Silliman, from 1818 to 1838; then by Prof. Silliman and his son, until 1845, when J. D. Dana, the well known mineralogist, joined the Sillimans, and a new series was commenced, which continues under the same management, in connection with Professors Gray and Agassiz and Dr. Wolcott Gibbs, an array of scientific names of the first class on this continent. A scientific journal, so long, favourably and widely known, both in America and Europe, requires no formal notice. It is sufficient to say that the first number of the XXXI. Vol., just issued, exhibits the same characteristics as those which have earned for its predecessors the reputation they enjoy.

The American Journal of Science and Arts ought of necessity to be found in all public libraries; and there are no prlvate individuals who make Science a study or a recreation who would not be amply repaid by receiving this excellent record of progress in science, both at home and abroad. It is published on the first of every second month. Price, $5 per year. The postage is prepaid by the Publisher after the payment of the year is received. B. Dawson, of Montreal, Maclear & Co. and Rollo & Adam, of Toronto, will receive orders.

The Chemistry of Common Life, by James F. Johnston, M.A., F.R.S., F.G.S. 10th edition. 2 vols. octavo. New York: D. Appleton & Co.

The author of this work has endeavoured to exhibit, in a manner as free from the abstruse technicalities of science as the subject will admit of, the Chemical and Physiological Wonders of Common Life. In this difficult undertaking he has succeeded to admiration, and furnished the public with a series of most instructive and interesting chapters on the following subjects:

I. The Air we breathe; II. The Water we drink; III. The Soil we cultivate; IV. The Plant we rear; V. The Bread we eat; VI. The Beef we cook; VII-IX. The Beverages we infuse—The Teas—The Coffees—The Cocoas; X-XI. The Sweets we extract—The Grape and Cane Sugars—The Manna and Milk Sugars; XII-XVI. The Liquors we ferment—The Beers—The Wines—The Brandies.

Volume II. contains: XV-XXII. The Narcotics we indulge in—Tobacco—The Hop and its substitutes, the Poppy and the Lettuce — Indian Hemp — The Betel Nut and the Pepperworts—Cocoa—The Thorn Apples—The Siberian Fungus, and the Minor Narcotics—General considerations; XXIII. The Poisons we select; XXIV. The Odours we enjoy — Volatile Oils and Fragrant Essences — The Volatile Ethers and Animal Odours; XXVI-XXVIII. The Smells we dislike—Natural Smells—Smells produced by chemical art — The prevention and removal of Smells; XXIX. What we breathe and breathe for; XXX. What, how and why we digest; XXXI. The Body we cherish; XXXII-XXXIII. The circulation of matter.

The Manufacture of Photogenic or Hydro-Carbon Oils, from Coal and other Bituminous Substances capable of supplying Burning Fluids, by Thomas Antisell, M.D. New York: D. Appleton & Co.

The author of this treatise is engaged in the United States Patent Office, where he has the charge of examining a large class of patented applications involving chemical processes. It may be presumed, therefore, that the sources of information at his command enable him to offer to the public a reliable account of the origin and present condition of this important manufacturing process. The work before us is a very good exposition of what is now doing in the United States in the distil-

lation of coal, bitumen, &c., as far as it goes; but the inexperienced manufacturer will find its information meagre on those points where he is most likely to be at a loss, namely, in the purification and utilization of the products of the distillation. The author does not profess to enter minutely into these details; but in a work bearing the above title, we naturally expect to find the whole process described as a scientific art in a commercial point of view. The practical contents of the treatise are chiefly limited to the mode of distilling coal, bitumen, &c. Its value would have been materially enhanced if two or three additional chapters had been added on the by-products, and on the best and cheapest mode of purifying the crude materials from those offensive hydrocarbons which are so objectionable to coal oils generally. The results of the destructive distillation of coal, wood, peat and bitumens, is yet in its infancy. The future developement of this remarkable art, with reference to the by-products, may be inferred from the extensive class of bodies of great commercial value which are directly or indirectly produced from the materials named above. These will be noticed in a separate article, in a future number of this journal.

MISCELLANEOUS.

ON THE PRINCIPLES OF THE SOLAR CAMERA.

BY A. CLAUDET.

The solar camera, invented by Woodward, is one of the most important improvements introduced in the art of photography since its discovery. By its means a small negative may produce pictures magnified to any extent; a portrait taken on a collodion plate not larger than a visiting-card can be increased, in the greatest perfection, to the size of nature; views as small as those for the stereoscope can be also considerably enlarged. This is an immense advantage, which is easily understood when we consider how much quicker and in better proportion of perspective small pictures are taken by the camera obscura, while the manipulation is so greatly simplified. There is nothing new in the enlargement of photographic pictures. This has been done long ago simply by attending to the law of conjugate foci; and every photographer has been enabled, with his common camera, to increase or reduce the size of any image. For the enlargement, it was only necessary to place the original very near the camera, and to increase in proportion the focal distance. But the more the focal distance was increased, the more the intensity of light was reduced; and a still greater loss of light arose from the necessity of diminishing the aperture of the lens, in order to avoid the spherical aberration. Such conditions rendered the operation so long that it became almost an impossibility to produce any satisfactory results when the picture was to be considerably enlarged. For these reasons, it naturally occurred, that if the negative, having its shadows perfectly transparent and its light quite black, was turned against the strong light of the sun, its positive image at the focus of the camera would be so intense that the time of exposure would be considerably reduced. So that, in order to employ the light of the sun, and follow easily its position without having to move constantly the whole camera, it was thought advisable to employ a moveable reflecting mirror, sending the parallel rays of the sun on a vertical plano-convex lens condensing those rays on the negative, placed before the object glass, and behind the condenser, somewhere in its luminous cone. Many contrivances for this object were resorted to, but without considering anything else than throwing the strongest light possible on the negative to be copied. The constructors of these solar cameras never thought it very important to consider whether the focus of the condensing lens was better to fall before or behind the front of the object-glass, provided the negative was placed in the luminous cone of the condenser. This want of attention has been the cause which has made the solar camera a very imperfect instrument for copying negatives. The beautiful principle of Woodward's apparatus consists in his having decided the question of the position of the focus of the condenser, and having placed it exactly on the front lens of the camera obscura. As this principle had not yet been explained when the invention was exhibited before the Photographic Societies of London and Paris, and not even by the inventor himself in the specification of his patent, Mr. Claudet has undertaken, in the interest of the photographic art, to bring the subject before the British Association, and to demonstrate that the solar camera of Woodward has solved the most difficult Problem of the optics of photography, and is capable of producing wonderful results. This problem consists in forming the image of the negative to be copied only by the centre of the object-glass reduced to the smallest aperture possible, without losing the least proportion of the light illuminating the negative. The solar camera does not require any diaphragm to reduce the aperture of the lens, because every one of the points of the negative are visible only when they are defined on the image of the sun, and they are so (in that position exclusively) for the centre of the lens is the only point which sees the sun, while the various points of the negative which forms the marginal zone of the lens are defined against the comparatively obscure parts of the sky surrounding the sun, are, as it were, invisible to that zone; so that the image is produced only by the central rays, and not in the least degree by any other points of the lens, which are subject to spherical aberration. It is, in fact, a lens reduced to an aperture as small as is the image of the sun upon its surface, without the necessity of any diaphragm, and admitting the whole light of the sun after it has been condensed upon the various separate points of the negative. It is evident that from the centre of the lens the whole negative has for back-ground the sun itself, and from the other points of the lens it has for background only the sky surrounding the sun, which fortunately has no effect in the formation of the image. Such is the essential principle of Woodward's solar camera, which did not exist in that instrument when the focus of the condenser was not on the object glass. This principle is truly marvelous, but it must be observed that the solar camera, precisely on account of the excellence of this principle, requires the greatest precision in its construction. For its delicate performances it must be as perfect as an astronomical instrument, which, in fact, it is. The reflecting mirror should be plane, and with parallel surfaces, in order to reflect on the condenser an image of the sun without deformation; and in order to keep the image always on the very centre of the object-glass, the only condition for the exclusion of the oblique rays, the mirror should be capable by its connexion with a heliostat of following the movements of the sun. The condenser itself should be achromatic, in order to refract the image of the sun

without dispersion, and to define more correctly the lines of the negative; and a no less important condition for loosing nothing of the photogenic rays would be, to have it formed with a glass perfectly homogeneous and colourless. With such improvements, the solar camera will become capable of producing results of the greatest beauty; and, without any question, its introduction into the photographer's studio will mark a period of considerable improvement in the art.

The Smelting of Lake Superior Copper.

The following are the practical operations in the smelting of American copper:—

"For the purpose of obtaining pure malleable copper from the masses, stamp and barrel-work sent down from the mines of Lake Superior, it is only necessary to separate the earthy matter which still adheres to the metal, and then to deprive the copper of the oxygen it has absorbed while in the liquid state. The furnaces are reverberatories of an ordinary construction.

"Sometimes the whole process is conducted in a single furnace. In this case the ore is charged into the furnace, mixed with a flux adapted to the nature of the earthy matter under treatment. The heat is kept up till the whole is fused, when the copper, owing to its greater specific gravity, sinks, while the liquid earthy matter or slag floats upon its surface. This slag is now drawn off the face of the copper by means of rabbles, and the metallic bath is exposed. During the fusion the copper has of course absorbed oxygen, which, if allowed to remain would render the metal to a great extent fragile. The surface is, therefore, covered with charcoal, and rods of green wood are plunged into the metallic bath, in order to reduce the oxide. The refining being completed, the metal is ladled out, and poured into moulds.

"At other times, two furnaces are used, and in that case the metal is first obtained in the form of pigs, which are afterwards refined. The slags taken from these furnaces are very rich in copper, containing numerous shots and flakes of copper diffused through them. They are therefore worked over again with an additional quantity of flux, in order to obtain as much as possible of this retained metal. Still the slag is found to contain too much copper to be thrown away. In order to obtain this, the slags are passed through a small cupola furnace. The resulting slag may be considered clean, but there has been an unavoidable waste of copper, which has volatilised at the high heat of the cupola and passed out of the chimney.

"The establishments at which the Lake Superior copper is worked, are at Detroit, Cleveland, Pittsburg and Boston."

Distillation of Coal.

One ton of Newcastle coals, of the average weight of 2,240 lbs., yields—

1 chaldron of coke	1494 lbs.
12 gallons of tar	135 "
10 gallons of ammoniacal liquor	100 "
9,000–10,000 cubic feet of gas	291 "
Loss	220 "
	2240 lbs.

Tables of the Expansion of Liquids and Solids.

EXPANSION OF CERTAIN LIQUIDS, Heated from 32° to 212° F.

Name of Liquid.	Expansion in Decimals.	Expansion in Vulgar Fractions.
Mercury	0·018018	$\frac{1}{55\cdot5}$
Do. in glass	0·015432	$\frac{1}{65}$
Water from its maximum density	0·043320	$\frac{1}{23}$
Muriatic Acid, sp. grav. 1·137	0·0600	$\frac{1}{17}$
Nitric Acid, sp. grav. 1·400	0·1100	$\frac{1}{9}$
Sulphuric Acid, sp. grav. 1·850	0·0600	$\frac{1}{17}$
Alcohol (to its boiling point)	0·1100	$\frac{1}{9}$
Water	0.0460	$\frac{1}{22}$
Water saturated with Common Salt	0·0500	$\frac{1}{20}$
Sulphuric Ether (to its boiling point)	0·0700	$\frac{1}{14}$
Fixed Oils	0·0800	$\frac{1}{12\cdot5}$
Oil of Turpentine	0·0700	$\frac{1}{14}$

LINEAR EXPANSION OF SOLIDS.*

(A bar ·1000 in length at 32° becomes at 212°).

Name of Solid.	Expansion in Decimals.	Expansion in Vulgar Fractions.
Glass Tube	1·00084000	$\frac{1}{1190}$
Plate Glass	1·00089080	$\frac{1}{1165}$
Crown Glass	1·00087572	$\frac{1}{1175}$
Glass Rod	1·00080787	$\frac{1}{1230}$
Platinum	1·00088420	$\frac{1}{1160}$
Palladium	1·00100000	$\frac{1}{1000}$
Antimony	1·00108300	$\frac{1}{925}$
Cast Iron	1·00111111	$\frac{1}{900}$
Steel	1·00118990	$\frac{1}{840}$
Blistered Steel	1·00112500	$\frac{1}{888}$
Steel, not tempered	1·00107875	$\frac{1}{930}$
Do. tempered yellow	1·00137000	$\frac{1}{730}$
Do. hardened	1·00122500	$\frac{1}{816}$
Do. annealed	1·00122000	$\frac{1}{820}$
Iron	1·00120000	$\frac{1}{833}$
Soft Iron, forged	1·00122045	$\frac{1}{819}$
Iron Wire	1·00123000	$\frac{1}{813}$
Bismuth	1·00139000	$\frac{1}{720}$
Gold, annealed	1·00146000	$\frac{1}{684}$
Do. Paris Standard, unannealed	1·00155155	$\frac{1}{645}$
Do. do. annealed	1·00151361	$\frac{1}{660}$
Copper	1·00180000	$\frac{1}{555}$
Brass	1·00184000	$\frac{1}{543}$
Brass Wire	1·00191000	$\frac{1}{523}$
Silver	1·00190000	$\frac{1}{528}$
Do. Paris Standard	1·00190868	$\frac{1}{527}$
Speculum Metal	1·001933[illegible]0	$\frac{1}{517}$
Malacca Tin	1·00193765	$\frac{1}{516}$
Tin from Falmouth	1·00217298	$\frac{1}{462}$
Grain Tin	1·00248000	$\frac{1}{403}$
Pewter	1·00228300	$\frac{1}{438}$
Soft Solder, Lead 2 + Tin 1	1·00250800	$\frac{1}{400}$
Zinc 8 + Tin 1	1·00269200	$\frac{1}{374}$
Brass 16 + Tin 1	1·00190800	$\frac{1}{527}$
Copper 8 + Tin 1	1·00181700	$\frac{1}{550}$
Lead	1·00284360	$\frac{1}{351}$
Zinc	1·00294200	$\frac{1}{345}$

* The numbers in this Table are the mean of those given by the best authorities.

Australia.

The problem as to the possibility of crossing the continent of Australia, from South to North, has been virtually solved, and no question now remains that a land transit may be opened up, available, not only for the general purposes of commerce, but also for telegraphic communication. Mr. Stuart, who started from Adelaide about last March on an exploring expedition, with two companions and a number of horses, has returned, after having crossed the country to a distance of about 1,600 miles from Adelaide and to within 300 miles of the Victoria river. Here he was turned back by a body of hostile natives; but, as he had already reached 100 miles further north than the point to which Gregory's expedition in 1856 descended from the Victoria, the continent may be considered, by the joint results of these surveys, to have been fairly opened up from one end to the other. Instead of an arid desert, it is described to be a practicable country throughout. The full details of the observations made were for the present, however, kept secret, the Parliament of South Australia having voted £2,500 to enable Mr. Stuart to start again with a larger and more strongly organised party, and a desire being entertained to prevent the triumph of final success being snatched from him by rival explorers in the other colonies, who might hastily avail themselves of all his information. Still, enough had been allowed to transpire to give a general idea of the route traversed. Mr. Stuart and his companions suffered terribly from want, not only of water, but of food, and also from an attack of scurvy. The part of the route in which water was totally absent, however, was only 60 miles. In many parts there was fine grass, besides splendid gum and other trees, including at least four kinds of palm. A very large salt lake was also discovered in the interior, supposed, from the blueness of its water, to be of great depth. The event had created great excitement and rejoicing at Adelaide, and the general impression was that a number of new provinces would ultimately be formed in the territory thus explored, and that meanwhile the tract might be made available almost immediately to facilitate communication with India, and especially the export trade in horses. The new expedition, which was to to start immediately, would consist of Mr. Stuart and one of his former companions, ten other well-armed men, and a suitable number of horses.

The Disc Wheel Propeller.

An experiment of a novel mode of propulsion in steam navigation has recently been made in a trip from Blackwall to Erith. The paddle-wheel and screw have hitherto been the means employed for utilising steam power in navigation, but Mr. James Jones Aston, of the Middle Temple, has, it appears, taken out a patent for propelling steam-ships by a very different contrivance. *A priori*, the arrangement invented by Mr. Aston, is the very last that would suggest itself to an observer, and the inventor himself candidly admits that both practical men and men of science ridiculed his idea when first propounded. The steam-tug *Saucy Jack*—by no means a favorable boat for the success of the experiment—was propelled down the river at a rate of six knots an hour by the agency of a disc wheel, and with a far less expenditure of coal than if either paddles or screw had been used. The earliest objection to the locomotive was that it would not "bite" the rail, but the experiment soon proved the objection to be worthless. It is still more difficult to conceive what hold a thin metal or wooden plate, not striking the water horizontally or obliquely, but cutting into it edgwise, like a knife, can have of the water. The diameter of the disc used in the experiment was 14 feet, with about two feet in the water. The thickness of the plate was only three-eighths of an inch. and it is asserted that the thiner the plate the greater the power. The engines of the tug were 30-inch, with a stroke of 42. The greatest number of revolutions made was 47. In the trip down the river the pressure in the boilers was 6lbs., and coming up 4lbs., the speed attained being about six knots. With the paddles the tug used to make about eight knots, but the expenditure of fuel was about 40 per cent. in favor of the disc. The conditions under which the trial was made was unfavorable to the experiment. She was not so readily started or so speedily stopped as the ordinary steamboats, but, perhaps, these disadvantages may disappear under more favourable circumstances. The disc may be constructed of metal or wood, or of both in combination, and several discs may be used on the same shaft, at convenient distances apart. There were five plates on each side in this experiment. The advantages of the disc, as enumerated by the inventor, are the following;—

1. It is less likely to be disabled in storm or battle, and is therefore a safer propeller.

2. There are no paddles or blades to agitate the water, and the boat is free from vibration.

3. All the action of the propeller is in the direction in which the boat travels, and the motive power being more perfectly utilised, a much greater rate of speed may be attained than has hitherto been deemed practicable.

4. Its action is perpetual, and not intermittent.

5. There is no backwater, or loss of power on that account.

6. It is much less affected by wind and tide.

7. It is the only propeller well suited for canals and shallow rivers.

8. It may be used for small boats and other craft.

9. It may be worked with lower power, and at great saving of fuel.

10. It is of more simple construction, less costly, less liable to injury, and causes less water and tear of the boat.

There were present to witness the experiment:—Capt. Lovell, of the Peninsular and Oriental Company; Mr. Wright, Assistant-engineer-in-chief to the Admiralty; Mr. Adams, Mr. Macrory, and Mr. Aston himself, the inventor and patentee.

Selection of Solders.

Solders must be selected in reference to their appropriate metals. Tin plates are soldered with an alloy consisting of from one to two parts tin, with one of lead. Pewter is soldered with a more fusible alloy containing a certain proportion of bismuth, added to the lead and tin. Iron, copper and brass are soldered with spelter—an alloy of zinc and copper in nearly equal parts. Silver is soldered, sometimes with pure tin, but generally with silver-solder—an alloy of five parts of silver, six of brass, and two of zinc. Zinc and lead are soldered with an alloy of from one to two parts of lead with one of tin. Platinum, with fine gold. Gold, with an alloy of silver and gold, or of copper and gold; &c.

In all soldering processes, the following conditions must be observed:—The surfaces to be united must be entirely free from oxyd, bright, smooth and level. The contact of air must be excluded during the soldering, because it is apt to oxydize one or other of the surfaces, and thus to prevent the formation of an alloy at the points of union. This exclusion of air is effected in various ways. The locksmith encases in loam the objects of iron or brass that he wishes to subject to a soldering heat; the silversmith and brazier mix their respective solders with moistened borax powder; the coppersmith and tinman apply sal ammoniac, resin, or both, to the cleaned metallic surface, before using the soldering-iron to fuse them together with the tin alloy.

Remarkable Phenomena on the Surface of the Sun.

On the first of September last, at 11h. 18m. a.m., a distinguished astronomer, Mr. Carrington, had directed his telescope to the sun, and was engaged in observing his spots, when suddenly two intensely luminous bodies burst into view on its surface. They moved side by side through a space of about 35,000 miles, first increasing in brightness, then fading away; in five minutes they had vanished. They did not alter the shape of a group of large black spots which lay directly in their paths. Momentary as this remarkable phenomena was, it was fortunately witnessed and confirmed, as to one of the bright lights, by another observer, Mr Hodgson, at Highgate, who, by a happy co-incidence, had also his telescope directed to the great luminary at the same instant. It may be, therefore, that these two gentleman have actually witnessed the process of feeding the sun, by the fall of metoric matter. But however this may be, it is a remarkable circumstance that the observations at Kew show that on the very day, and at the very hour and minute of this unexpected and curious phenomenon, a moderate but marked magnetic disturbance took place; and a storm or great disturbance of the magnetic elements occurred four hours after midnight, extending to the southern hemisphere. Thus is exhibited a seeming connection between magnectic phenomena and certain actions taking place on the sun's disk—a connection which the observations of Schwabe, compared with the magnetical records of our colonial observatories, had already rendered nearly certain.—*British Association.*

Value of Manufactured Earthy Minerals in the United Kingdom.

Bricks, tiles, &c.	£2,911,980
Building and other stones	4,622,924
Superior kinds of clay, china stone	285,846
Sands	10,250
Coprolites	65,500
Rotten Stone	750
Ochre, Umber, &c.	5,450
Barytes	15,500
Gypsum	17,750
Fuller's Earth	13,500
Fluor Spar	4,625
Total value of the Earthy Minerals	£7,954,075

A cubic yard of bricks is estimated to contain 384 bricks, and on the average about 373 bricks go to the ton.

Value of Minerals in the United Kingdom.

The total value of metals, metalliferous minerals and coal produced in 1858, was £31,266,932 stg. If to this immense sum the value of the manufactured earthy minerals be added, the total product of the mine will be represented by nearly £40,000,000 stg.

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation, by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside,

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

PATENTS OF INVENTIONS,

As issued by the Bureau of Agriculture and Statistics, to 4th January, 1861.

His Excellency the Administrator of the Government has been pleased to grant Letters Patent of Invention for a period of fourteen years, from the dates thereof, to the following persons, viz:

David Buckler, of Garafraxa, County of Wellington, School Teacher, for "A Chair or Lounge, termed the "Lazy Man's Friend."—(Dated 25th September, 1860.)

Francis Marshal Ackerman, of the Village of Morven, County Addington, Mechanic, for "An article termed the "Ackerman Washing Machine,"—(Dated 12th October, 1860.)

Eugene Cooper, of the Township of Oneida, County Haldimand, Farmer, for "A Stumping Machine,"—(Dated 22nd October, 1860.

David Tees, of the City of Montreal, Undertaker, for an "Air-tight Coffin or Burial case, denominated by him "Tees's Air-tight Coffin or Burial Casket."—(Dated 25th October, 1860.)

David Klein, of the City of Quebec, Mechanic and and Merchant for "A Floating Bridge."—(Dated 13th December, 1860.)

THE JOURNAL
OF THE
Board of Arts and Manufactures,
FOR UPPER CANADA.

MARCH, 1861.

CANADA AT THE INTERNATIONAL EXHIBITION OF 1862.

The necessary preliminary arrangements for the INTERNATIONAL EXHIBITION OF 1862 have been completed. The Exhibition is to be held in London, and already upwards of one million eight hundred thousand dollars are guaranteed. Active measures are being taken in more than one British colony to secure an advantageous representation of their products and to create a favourable impression. No better means of advertising the natural resources of a country exist, than by offering specimens and illustrations to the gaze and criticism of the millions who will visit the International Exhibition of 1862. It is an opportunity for Canada of priceless value, placed as she now is, by the completion of her system of railways, in a very different position to what she held in 1851 and 1855. The Exhibitions of 1851 and 1855 opened the eyes of Europeans to the natural resources of this country. An event has lately happened—the visit of the heir of the throne of England—which for the time fixed the attention of the civilized world on Canada, and led men to discuss its position, its relations, and its future. The Canadian system of railways, the offspring of British capital and enterprise, has already made this part of North America a subject of special interest, secure for many years to come; and while every discovery and development which tends to improve the condition of the country, increase its industry, and establish it as a great highway of commerce, is hailed with delight by those who are personally interested in its welfare, so also would an honourable and striking position as a competitor among the nations of the earth establish a reputation scarcely yet won, however much it may be deserved.

The Exhibitions of London and Paris have been productive of immense benefit in many different ways. Manufacturers of all countries know their standing and to a certain extent their future, far better than they did before those splendid illustrations of the industry and skill of man opened their eyes either to their short comings or superiority, their advantages and disadvantages of position, resources, government, capital, and individual enterprise. From the unbiassed opinion of the most competent judges at the Exhibiton of 1851, we learn one secret of the success of Canada in that magnificent arena of peaceful strife and rivalry, in one department of our staple productions. SELECTION and ARRANGEMENT in exhibiting the mineral resources of Canada won for us the proud distinction of being "SUPERIOR SO FAR AS THE MINERAL KINGDOM IS CONCERNED TO ALL COUNTRIES WHICH FORWARDED THEIR PRODUCTS TO THE EXHIBITION." Why should not the same coveted honour be conferred upon our next display of the resources of Canada, as far as they go, in agriculture and the products of our forests. No doubt the material is available if sought for; and when selection and arrangement confer such marked advantages, it is not too much to expect that those artifices may be most advantageously employed in placing all our staple products in the rank they would undoubtedly acquire if justice be done to them by the Exhibitors. A whole year is available for the enterprise and energy of those who intend to enter the lists, and the action of the government in this important matter will probably soon be known.

It was a common subject of complaint at the period, that sufficient time was not given to exhibitors to prepare articles for the Paris Exhibition of 1855. In October, 1854, the then Provincial Secretary first communicated the documents received from the Board of Trade of London, relative to the Exhibition of Paris, to be held early in the following year. A Provincial Committee, composed of about 200 persons, met on the 30th October; they appointed a sub-committee, who, after due deliberation, arrived at the following conclusions:

> "That it is absolutely necessary, in order to secure the end desired, that authority should be given to the Provincial Committee to purchase such articles as they deem essential to that object. They are of opinion that any attempt to induce voluntary effort by means of local fairs would be fruitless. The experience of all who were actively engaged in promoting the Canadian Exhibition at the World's Fair in London in 1851, is, that the success of the present effort must depend entirely upon the energy and judgment to be displayed by an efficient executive to be appointed by the Commissioners."

On the 4th November, the Executive Committee published a brief report, in which they called especial attention to the three classes of the great staple products of Canada, namely, minerals, agricultural productions, and timber. The following extracts from the reports of the Jurors of the Exhibition of 1851 will convey the opinions entertained by those most competent to judge how essential it is to have a full and complete representation of these departments of Canadian industry and resources in the Exhibition of 1862.

In the report of the Jurors of Class 1, on mineral products, by Mr. Dufresnoy, Member of the Institute of France, Inspector General of Mines, &c., it is said:

"Of all the British colonies, Canada is that whose exhibition is the most interesting and complete, and one may even say that it is superior, so far as the mineral kingdom is concerned, to all countries that have forwarded their productions to the Exhibition. This comes from the fact that the collection has been made in a systematic manner, and the result is, that the study of it furnishes the means of appreciating at once the geological structure and the mineral resources of Canada. It is to Mr. Logan, one of the members of the Jury, who fills the office of Geological Surveyor of Canada, that we are indebted for this collection, and its value arises from the fact that he has selected on the spot most of the specimens that have been sent to the Exhibition, and arranged them since their arrival in London."

In the report of the Jurors of Class 3, "Substances used as food," by Dr. Hooker, it is said:

"Messrs. Lawson's collection exhibits the ear and grain of every variety of cereal, and also models of all the roots which it has been found practicable to cultivate in Scotland; the specimens are beautiful, and the arrangements scientific and excellent. No consideration of cost or trouble has been allowed to interfere with providing all that is necessary to render this collection a true and complete illustration of the vegetable products of Scotland. A council medal has been awarded to Messrs. Lawson for their admirably displayed, very complete, instructive and scientifically arranged collection of the alimentary products of Scotland."

The Jurors of Class 4, in their report on animal and vegetable substances chiefly used in manufactures, as implements, or for ornaments, by Professor Owen, say:

"Among the numerous samples of raw produce contributed by different countries, there are several collections of especial value which derive additional merit from their completeness and from the fact that they illustrate the trade and manufactures of an entire country. The importance of such collections, not only in a commercial but in a statistical and scientific point of view, is very great, and the Jury therefore, being desirous of expressing their approbation of the practical benefits to be derived from the formation and study of such collections, and the advantages which the commercial and manufacturing community may obtain by their means, have determined to recommend the award of the council medal to the governments of those countries, the natural products of which were so instructively and completely exhibited."

The entire cost to the government of the Canadian Department at the Paris Exhibition amounted to $67,300. The results obtained were valuable, and would no doubt serve to bring Canada prominently before the reading public. Mr. Taché, in his report, enumerates the following opinions of competent authorities.

The chapter under the title Canada, in the history of the Universal Exhibition, by Mr. Charles Robin, begins with these words: "The efforts made by Canada, that old French colony, to make a suitable appearance at the Great Exhibition of 1855, efforts which have resulted, moreover, in the most complete success, coupled with the undoubted importance of that fine country, whose future cannot be otherwise than brilliant, render it a duty on our part to devote to it a distinct chapter."

"*Now we can form an estimate of the value of those few arpents of snow ceded to England with such culpable carelessness by the Government of Louis XV.,*" says Count Jaubert at the word CANADA, in his work entitled *La Botanique à l'exposition universelle de* 1855.

Baron Wedekin, Chief Ranger of the Duchy of Hesse, and compiler of the records of the German forests, writing to Mr. Taché, states: "In conclusion, I congratulate you upon your Canada. Although the feeling in favor of emigration has very much diminished in Germany, I would recommend Canada to the Emigrant in preference to any other country."

The standing acquired by Canada, in competing with other nations and colonies, may be inferred from the fact that the prizes received at the Great Exhibition of London, in 1851, were 67 medals and honorable mentions; at New York, in 1853, 63 similar distinctions; and at Paris this number was increased to 93; Canada being the only instance of a Colony having obtained a grand medal of honour, a distinction won but not exceeded by the nationalities of Sweden, Denmark, Lombardy, Piedmont, and Bavaria.

The experience gained by being twice placed in contact with the highest intelligence and the most productive skill of the world ought to be of vast benefit to Canada in view of the Exhibition of 1862. It has been shown that the productions of the forest, the mine and the farm, constitute our wealth and the foundation of our future position; but it has at the same time been made manifest, that we do not make a tithe of the use of the natural resources belonging to the country, which unexampled facilities place within our reach. In the productions of the forest, Spain far surpassed Canada; not so much by the practical usefulness of the products exhibited, but by the scientific skill shown in the admirable arrangement of her contributions. The collection of Spanish woods was accompanied with specimens of the bark, leaves, flowers and fruit of the trees and shrubs. When the numerous artifices employed by manufactures to give beauty or durability to forest productions are known, the advantage of fully representing the capabilities of a contribution become manifest.

Mr. Taché correctly tells us, in his report of the Paris Exhibition, that "In lumbering, as the making of timber is termed in Canada, just that amount of intelligence is brought into action which is required for the squaring of the logs and the sawing of them into the planks of commerce. None of that skill of woodcraft is exercised which turns to the best and most profitable account the various species, by attending to their several degrees of adaptation to the mechanic arts, and to the preparation to be

expended on them to make them fit for market. As before observed, two things only are known, square timber and the plank three inches thick.

"Of more than sixty principal species of timber which we possess, we make profitable use of scarcely ten; the rest are left to absolute decay. In Europe, the bird's eye maple is considered as equal to the most precious of the woods used in cabinet work. It is indeed hardly attainable, and, when found, it bears a higher price than mahogany. From this cause arises the dearness of all the articles made of maple in the Parisian cabinet work, the finest in the world."

Sufficient has been said to show that the primary elements of success in the display which Canada will make in 1862, are embraced in the SELECTION and ARRANGEMENT of the products of her industry or natural wealth. Ample time exists for a complete illustration of whatever this country is capable of producing, in the most intelligent and comprehensive manner. It is one thing to show specimens of inexhaustible supplies of mineral, forest or agricultural products, but it is another to teach the eye and understanding at a glance the wide application and general usefulness of the raw materials. A table pier or a chimney piece of Labradorite, exhibiting the exquisite beauty and adaptation of that material for ornamental purposes, would arrest the attention of the most superficial observer; but rude blocks, however massive, might possess a passing interest to the scientific geologist, and would then be forgotten. So also with our marbles, soap stones, slates, and hydraulic cements; our different varieties of forest woods used by the cabinet maker; our natural dyes, and all other products which, possessing great intrinsic worth, nevertheless require skilful labour to be employed upon them before they can occupy their true position in the resources of a country.

Selection and arrangement will be, as heretofore, the key to our success in the great Exhibition of 1862, and no expense should be spared or time lost in preparing to illustrate to the utmost the adaptation to the wants of mankind of those natural productions which form such an important part of the undeveloped wealth of Canada.

EUROPEAN EMIGRATION TO CANADA.

An able writer in the last issue of the *London Quarterly Review* commences an article on "CANADA AND THE NORTH WEST," with the following quotation.

"The people of England are by no means aware how fine a country they possess here."

It is scarcely necessary to say that Canadians are but too familiar with the deplorable absence of appreciation of their country, arising from ignorance of its position, extent and resources, which exists among the masses in Britain. In many ways has this feeling found expression, and latterly in a very decided and official form.

The Select Committee appointed to take into consideration the Annual Report of the Chief Emigration Agent at Quebec, for the year 1859, reported on the 23rd April, 1860. Among the circumstances which control the European Emigration to Canada, the following all-important influence is enumerated:—"The circumstance which primarily controls the Emigration to this Province, may be said to be, THE IGNORANCE OF ITS EXTENT, INSTITUTIONS AND RESOURCES, which prevails in the emigrant countries.

"The first shocks were given to this ignorance at the London and Paris Exhibitions of 1851 and 1855, when the products of our fields, forests and workshops came under the notice of intelligent men from every part of Europe. The advantage then obtained was not however promptly followed up; for although several useful pamphlets have been issued by the Bureau of Agriculture and Statistics, and an extensive correspondence has been maintained by its efficient Secretary, Mr. Hutton, the fact still remains patent to every traveller, that the vast majority of Europeans are only familiar with one North American country—the United States—and one North American Seaport—New York."

Again, in the report of the Select Committee appointed to consider the expediency of inviting emigration from France, Belgium, and Switzerland, to Canada, the Committee truly state that "the people of the remote departments in France, are in utter ignorance as regards Canada. In the large cities it is barely known by name. The Paris Exhibition, held in 1855, in which the products of our soil figured to such great advantage, helped to dispel their ignorance in a slight degree; but the light thus momentarily afforded, must soon be obscured in the absence of established relations between the two countries."

The appointment of Resident Provincial Agents at important Sea Ports, with extensive powers for distributing information, appear to embody the most important recommendations and suggestions of both Committees. The Sea Ports named, are Christiana, Hamburg, Liverpool, at whatever Irish Ports the Canadian Line of Steamships may make a port of call, Havre and New York. There can be no doubt that this recommendation is of great value as far as it goes, and one which must be the most efficient instrument for diffusing information among those who are already determined to emigrate, and who are yet undecided in the choice of a home, whether on the American Continent or in Australasia. This recommendation, however, does not strike at the root of the evil, namely, the IGNORANCE OF

THE EXTENT, INSTITUTIONS, AND RESOURCES of Canada, which the Exhibitions of 1851 and 1855 served to dispel for a time among the more enlightened classes who visited those splendid collections of human art and wisdom, and among the masses whose attention was for the time awakened to what was meant by the word CANADA. "The light thus momentarily afforded was soon obscured," and but a dim and confused impression remained in the minds of the working classes in the United Kingdom until the visit of the Prince of Wales restored recollections, stimulated enquiry, and turned public attention to this country to a far greater extent than at any previous period. The great Exhibition of 1862 may render this interest permanent if energetic steps are taken to represent the country, and to place in the hands of the influential people in the United Kingdom, the means of distributing information which will no doubt be again eagerly sought after by many desirous of trusting their fortune beyond the seas.

It does not require a very familiar acquaintance with the social condition of the people of the United Kingdom, to know that the masses are influenced to an extraordinary degree by those occupying positions of authority and power. The country gentlemen are the oracles to whom the labouring farm classes look for advice and guidance. This is the class which should be made acquainted with "the *extent, institutions, and resources* of Canada," and through them the information will be conveyed to the intending emigrant, and from them only will such information be received with reliance, and acted upon in confidence and hope. A broadcast distribution of pamphlets and maps is comparatively useless. Information, ample, practical and illustrated, must be placed in the hands of COUNTY AUTHORITIES and COUNTRY GENTLEMEN, in connection with a full representation of our progress at the Exhibition of 1862, before we can expect a healthy return of that tide of emigration which poverty and distress contributed to swell in by-gone years, but which for the future should be the natural result of the advantages which Canada can offer to the industrious man, of winning a position of independence and security for himself and his children.

PETROLEUM, OR ROCK OIL.

No. II.

The immense importance which "Rock Oils" are now assuming, from the discovery of new sources of supply, coupled with the doubts which hang over the real origin of this important substance, give interest and value to every kind of information upon which reliance can be placed. Some fresh discoveries of Petroleum have recently been made in Ohio, and in the Township of Dereham, C. W., which appear to show that the area over which we may expect to meet with this substance in remunerative quantities, is considerably greater than was but very recently supposed. Mr. J. S. Newberry, in a paper on "the Rock Oils of Ohio," published in the *American Gaslight Journal*, (January 15, 1861,) expresses an opinion respecting the source of the Rock Oils of Ohio, which if borne out by facts, will materially extend the area in Western Canada, over which productive springs may be searched for with success. Mr. Newberry says:—

"I have said that the Waverly series or the Chemung and Portage rocks—are *the* oil rocks of Ohio. By this I mean that they are the principal repositories of oil—the source from which we are mainly to derive the millions of gallons which will be annually used in, or exported from the State—the geological level along which we must look for new discoveries of petroleum.

"That the oil *originates* in this group of strata is, however by no means certain. On the contrary, it seems more probable that it merely accumulates in them, as a convenient reservoir, when flowing from another source. These rocks are mechanical sediments, and are, in Ohio, generally destitute of organic remains, whether animals or plants. They are, however, often quite porous, and strong currents of water flow through them. The Hamilton Shales, on which they rest, contain an amount of carbonaceous matter probably equal to all that included in the coal measures. Here, I suspect, most of the oil originates. From this bituminous mass, as distilled by nature's processes, it would rise through every fissure by the pressure of the incumbent rocks, or water, which is specifically heavier. A few layers of the Waverly series are highly charged with the debris of vegetables and marine shells; and these may generate some oil; but for the most part what they contain is of foreign origin. The source to which I have referred it is so entirely sufficient, both as regards its position and character, that it seems unnecessary to look farther.* Over nearly all the northern part of the State, where the Portage and Chemung rocks are exposed, petroleum may be found exuding from them in greater or less abundance; but it is only at comparatively few points that it is found in a "paying" quantity.

"The Oil Creek region of Pennsylvania is one of these series of oil centres. There the wells are sunk from 70 to over 300 feet—often to, and sometimes apparently through the Portage group. The oil occurs at all depths. It is frequently found saturating the surface deposits, and the deepest bore has not reached beyond it. It flows in fissures with water, and that from neighboring wells differs much in quality; all of which facts seem to indicate that it is derived from a somewhat remote source below. The oil of Titusville is very thin, varying shades of brown in color, and has a specific gravity of 35° to 40° Beaume.

"Not very far distant from the Oil Creek district is that of Mecca, Trumbull county, Ohio. Here some 200 wells are being bored, and a dozen or more have been successfully pumped. The geological level of the Mecca wells is the same as that of Titusville, but they are generally less deep; varying from 30 to 200 feet, while

* In confirmation of the view that the oil of the Portage and Chemung rocks for the most part rises from the Hamilton Shales, it may be said that at Titusville, Mecca, Grafton, &c., the oil is found exuding from cracks in the surface rocks, coming up from below, and saturating the soil; and that in boring, the most abundant flow of oil is also obtained from vertical crevices at very unequal depths, in holes closely approximated.

most are about 50. The rock is a soft bluish-white sand-stone, with partings of clay-shale, sometimes quite saturated with oil. The yield of the wells is from 5 to 20 barrels each per day. The oil is much thicker than that of Pennsylvania, has a greenish brown color, and comparatively little odor. Its specific gravity is from 28° to 30°. For many miles around Mecca signs of oil are found—in the wells sunk for water, on the surface of streams, &c., and the aggregate production of oil from that district will unquestionably be very large.

"At Lowellville, Mahoning county, thirty miles south-east from Mecca, a single well has been bored to the depth of 157 feet, and it is said to be now yielding some 20 barrels of oil per day. This well is sunk through the conglomerate which is there thin, and into the Chemung. The oil is similar in character to that of Titusville; is light, reddish-brown in color, and has a specific gravity of 38° Beaume. The oil enterprise at Lowellville is, as yet, in its infancy, but it seems probable that the quantity ultimately raised there will be large.

"At various places near Cleveland, and in the valley of the Cuyahoga, oil makes its appearance; generally flowing from the Portage rocks. Whether it will be found here in abundance is, at least, doubtful.

"At Grafton, Lorain county, and in Liverpool, Medina county, adjoining townships, the Portage rocks contain much oil; a number of wells have been sunk which promise well, but operations are just commencing there and little oil has been raised. The Grafton oil is darker and thicker than that of Mecca, having a specific gravity of about 25° Beaume.

"On Duck Creek, in Noble county, petroleum has been procured for many years from the salt wells. Within a few months past, wells have been sunk expressly for the oil, with success, but how much is now raised there, or what is its quality, I have not definitely learned."

The area occupied by the Hamilton Group in Canada West, is very considerable, and it may be said according to the present state of our knowledge of the geographical boundaries of formations in Canada, to extend over the following Counties:—Lambton, part of Kent, Middlesex, Elgin and Norfolk. In Lower Canada Petroleum occurs in the Valley of the River St. Jean, and the Ruisseau Argenté (Gaspé). On another page will be found an extract from the *London American*, on the Oil Wells of America, from which some idea of the importance of this new element of wealth may be obtained. The numbers given are probably overrated, but there can be no doubt that Petroleum is destined to become a most important commercial product, and a very valuable source of wealth.

Besides the employment of this substance as an illuminator, some varieties are excellent lubricators, and all can be made to fulfil that purpose by proper manipulation. Mr. Newberry states in his paper on the Rock Oils of Ohio, that—

"As yet the attention of refiners of coal-oil and petroleum in this country has been confined to the products most readily derived from them, viz.: burning fluid, lubricating oil, and paraffine; but the European manufacturers have demonstrated that the process may be profitably carried much farther, and that other and more valuable secondary products may be derived from those first mentioned. By the re-distillation of the light oil, they obtain: 1st. *Benzole*, worth from 10 to 20 cents per pound. This is exclusively used as a solvent for india-rubber, gutta-percha, &c., and for extracting oil from wool before dyeing it, grease from clothing, carpets, gloves, &c., &c. 2nd. *Nitro-Benzole*, which has the taste and smell of oil of bitter almonds, and is used for the same purposes. This is worth $1 per pound. 3d. *Aniline*, a dye used for producing the fashionable color *Mauve* — $6 to $8 per pound. 4th. *Pure violet Aniline powder*, $250 to $325 per pound.

"All these may be obtained from the natural oils, perhaps in as great abundance, and as easily as from those distilled from coal."

CONDITION AND PROGRESS OF FOREIGN COUNTRIES IN MANUFACTURING INDUSTRY.

No. 3.—Italy. *

What is the present state of industry and commerce in Italy? As from the snowy tops of the Cenis or the St. Gothard, we gallop towards Italy, what first arrest our eyes are those impetuous waterfalls which descending into the beautiful lakes below, by numerous canals and navigable rivers spread themselves over the fertile plains of Lombardy. Nowhere has the hand of man seconded so ably the gifts of nature. Where can we find a system of irrigation more perfect than that which enriches the Milanese territory? The works of Leonardo da Vinci, Raffaelle, and Brabanti, are to this day the admiration of the world. Hence the advanced condition of agriculture in the great plains of Northern Italy. Whilst the land is in a manner forced to produce a constant succession of grass and grain, the vine and mulberry beautify the country, and give employment to the dense population. In Southern Italy the vine, the olive, and the mulberry, are the chief objects of culture; but the system of irrigation and drainage is not so perfect as in the north. Whilst some portions of land have but little water, other portions are often inundated with water, charged with an enormous quantity of vegetable matter carried from the mountains. As a whole, the agricultural riches of Italy are considerable, and her industry is well rewarded.

In mineral riches Italy is not so fortunate. The great want in Italy is fuel. Timber is dear, and the only substitute for coals is the deposits of anthracite, a mineral substance, consisting of carbon, with a minimum amount of hydrogen. Yet Tuscany abounds in copper, iron, mercury, lead, boracic acid, &c. Tuscany is to Italy what Cornwall is to England and Hungary to Austria. At best, however, the productions of the mines are indeed small. But let us pass to other industries.

The production of Silk, and the different industries attached to it, are of great importance. Northern Italy alone produces silk to the amount of £7,000,000 to £8,000,000, and of a quality far superior to the productions of any other country. China and India are now sending to Europe immense quantities of silk, yet the Italian organzine and other filatures are as much required as ever. The Straw-work manufacture of Tuscany is of great value. Tuscany alone produces the raw material, and the value of straw hats exported is well nigh £1,000,000 per annum.

* Abridged from a paper by Professor Leone Levi, published in the *Journal of the Society of Arts.*

The marbles of Carrara, the ornamental stones termed Mischio di Saravezzo, the alabaster and serpentine, are not only productions of immense value, but are the materials of industries strictly national. The manufacture of mosaics in Florence has a world-wide fame, and wherever we travel, and whether we inspect the palaces of sovereigns, or galleries of art, everywhere we find the productions of the Italian chisel, the glories of Italian art. But Italy is not only rich in works of art and articles of luxury; her fertile land and her rich pasture afford the most delicious and most nutritive articles of provisions. Much I might say of the Parmesan Cheese of Milan, Lodi, and Pavia, on the extensive production of excellent wine throughout Italy, as we well know, by the Nasco of Sardinia, the Aleatico of Tuscany, the Vino Santo, and Lacryma Cristi of Sicily; and also on the rice, grain, maccaroni, and fruits which find a market throughout Europe. Nowhere, perhaps, can we find more varied productions and industries than in Italy. But they want growth and expansion. They only indicate what they might become under more favourable auspices. Our acquaintance with Italian produce and industry is very imperfect; even the recent Universal Exhibition failed to display in a proper manner what Italy can furnish to the world. In 1851, the number of exhibitors from Tuscany, the Roman States, and Sardinia, was about 200, but Lombardy and Venice were concealed under the huge heading of Austria, and the Two Sicilies were not represented. At the Universal Exhibition of Paris, in 1855, the number of exhibitors from the Roman States, Tuscany, and Sardinia, was nearly 500, but the same deficiencies were experienced as regards Lombardy, Venice, and Naples. We shall soon see what Italy will exhibit in 1862. Assuming that the work of regeneration, and the reform of abuses, now vigorously in progress, must occupy the attention of the Italians for some time to come, it will be from 1862 that the economical progress of Italy will date. Let us hope that an effort may then be made to exhibit in a thorough manner the various resources of that gifted land, and that thenceforth our trade with Italy may double or treble the present amount. Our imports thence probably amount now to £3,000,000, not including, however, the Italian silk which arrives here through France; and our exports to Sardinia, the Italian-Austrian States, Tuscany, the Papal States, and Two Sicilies, exceed £6,000,000.

The present amount of commerce in Italy is doubtless immensely inferior to that of the United Kingdom, France, or the United States, yet if we take all the States together, the imports of Italy will amount to about £30,000,000 and the exports to £26,000,000, a tonnage entered and cleared of nearly 4,000,000 tons, with a mercantile marine of 700,000 tons. In the last decennium the commerce of Sardinia has more than doubled, but that of other States has shown but little improvement. No better evidence can be produced of the superior position of the Northern States than the fact that while Sardinia exports at the rate of 32s. per head, the exports of Tuscany average 25s., those of the Roman States 11s., and those of the Neapolitan States barely 8s. per head. As yet the exports of Italy consist principally of her own produce, and of articles prepared for manufacturing purposes. In cotton, woollen and linen manufactures, the modern wonders of mechanical power, Italy cannot think of competing with Great Britain, though she produces considerable quantities of such articles for her own consumption. There are, however, no positive hindrances to her achieving, even in these, considerable distinction. No climate is better adapted than the Italian for vividness and brilliancy of colour. Dyewoods they may have in abundance. The water is good, and as for power of inventiveness, we might well trust the land of Raffaelle, Correggio, and Carracci.

But what has become of the great Italian Republics? Their institutions are gone for ever. They are the shadow of the past. Yet some of them still preserve considerable importance. Genoa is the chief outlet for the Mediterranean of the manufactures of Switzerland, Lombardy and Piedmont; and Lombardy receives most of the foreign articles imported through Genoa. She has a population of 120,000, an excellent harbour, a commerce of importation and exportation amounting to £15,000,000, and a mercantile marine amounting to 200,000 tons. She has large manufactures of silk, cotton, wool, hides and leather, and considerable foundries and establishments of mechanical engineering. There is life in Genoa, and she will be the first to benefit from the extension of the territories in Northern Italy. Leghorn is by no means unimportant. She has a population of 100,000, and an export and import trade of about £7,000,000 to £8,000,000. Naples, also in the Mediterranean, is a large seaport, the principal port, in fact, of the Two Sicilies, with much trade and extensive manufacture. Civita Vecchia is of no great importance. In the Adriatic, Ancona is essentially a mercantile city, with a large marine; but Venice, still prostrate under the galling yoke of Austria, has but little left of her former glory. When will she rise as a man to shake off the chains of her slavery?

ECONOMICAL CONDITION OF ITALY IN 1856.

	Population.	Imports.	Exports.	Revenue.	Expenditure.	Debt.	Shipping.
		£	£	£	£	£	Tons.
Sardinia (continent) ...	4,368,972	15,852,711	12,523,164	5,438,692	5,749,074	27,224,000	177,000
" (island)	547,112	587,815	460,070				
Tuscany	1,796,078	3,006,564	2,323,236	1,265,591	1,297,029	4,662,442	31,000
Roman States..............	3,124,668	3,253,734	1,676,386	3,039,321	3,135,436	2,500,000	30,000
Two Sicilies	9,117,005	3,210,819	1,468,709	5,000,000	5,000,000	2,000,000	220,000
Lombardy..................	3,009,505	2,156,392	6,205,753				
Venice	2,493,908	1,958,266	647,500	...	...	...	30,000
Tyrol	925,066	700,000	300,000				
Modena....................	600,676	250,000	53,800	300,000	300,000	...	
Parma	508,784	190,000	150,000	370,000	370,000	...	
	26,491,834	30,166,301	25,808,618	...	...	36,386,442	488,000

ARTICLES OF ITALIAN EXPORT IN 1856.

Brandy	4,000,000	galls.
Wine	8,000,000	"
Olive Oil	23,000,000	lbs.
White Lead	1,200,000	"
Bark of Pine (tanned)	2,700,000	"
Fruit (green)	28,000,000	"
Oranges and Lemons	1,200,000	boxes
Seed, Oleaginous	2,200,000	lbs.
Hides, wet and dry	2,300,000	"
Cotton, raw	12,000,000	"
Wool	80,000,000	"
Silk, waste	1,000,000	"
" prepared for throwing	15,000	"
" raw	8,000,000	"
" thrown	2.000,000	"
" manufactured glacé	90,000	"
" thread	250,000	"
Rice	50,000,000	"
Maccaroni	4,000,000	"
Paper	3,000,000	"
Hardware	100,000	"
Coral, wrought	45,000	"
Machinery	22,000,000	"
Lead Ore	15,000,000	"
Hemp	25,000,000	"
Stone and materials for building	50,000,000	"
Cordage of hemp	1,500,000	"
Skins and furs	700,000	"
Works of modern art, sculpture, painting, &c.	500,000	"
Works of alabaster	400,000	"
Rags of all kinds	4,500,000	"
Chestnuts	40,000	"
Raw Copper	400,000	"
Borax	3,000,000	"
Bark	10,000,000	"
Soap	300,000	"
Straw hats	500,000	"
" manufactures of	10,000	"
" plaited for hats	400,000	"
Almonds	1,000	cwts.
Argols	12,000	"
Fruits—dry figs	24,000	"
Liquorice	10,000	"
Nuts, &c.	8,000	"
Sulphur	8,000	"
Shumac	700,000	"
Cream of tartar	26,000	"
Linseed	10,000	"
Brimstone	2,500,000	"
Manna	2,800	"
Fish, salted	6,000	"
Barilla	184,000	"
Cheese	800,000,000	"
Timber for building		
Grain		
Animals, &c.		

No. 4.—Portugal.

The population of Portugal in 1857 was 3,908,861, or a proportion of 1,209 souls to the square league, one of the thinnest in Europe, but higher than Spain, which is 1000.

The contrast between the northern and southern Portuguese is as striking as that between their respective territories. The former are comparatively active and enterprising, while the latter are indolent and obstinate. The Minho province is, at least, cultivated to the extent of one-fifth of its surface, while not one-fifteenth part of Alemtejo is tilled. Still the latter province is by no means unproductive. What few attempts at improvement have been made are due to settlers from the northern provinces.

The causes of this difference between two provinces of the same kingdom, inhabited by the same race, are of very old standing. They go back as far as the Moorish wars, when the southern provinces were completely depopulated, and were constituted into extensive fiefs, or "morgados." These "morgados" were placed under a special legislation, which subsists to this day, to prevent their subdivision.

The average amount of taxation was 12s. per head in 1857 and 1858; but the whole expenses of government amounted to £3,973,134, or about £1 per head. The debt is increasing at the rate of £3,300,000 per annum.

Unlike what occurs in other constitutional countries, here the budget is not discussed or voted at all by the Chamber of Deputies. At the end of the session a law is generally passed giving the Government full power to collect taxes and pay expenditure in conformity with some former budget. This suits the convenience of the Ministry, as it virtually makes them the sole judges of what expenditure is requisite during their tenure of office. The constant increase of expenditure is not, then, to be wondered at.

With reference to manufacturing industry, there appear, by the last returns, 36 hat manufactories, 21 tanneries, 12 metal-foundries, 16 earthenware or glass factories, 28 paper-mills, 17 dyeing or printing works, and 189 spinning or weaving establishments; in all, 362 manufactories, employing 15,897 operatives of both sexes. By a manufactory is understood an establishment employing ten or more hands.

The great desideratum of Portugal is, still, means of communication. Other improvements would then soon follow. It is admitted by every Government; for immense sums have been voted at different times for the purpose of making both roads and railways, with little apparent result. Numerous contracts have been passed, with capitalists of all countries, but still everything remains to be done.

WINE TRADE—PORT WINE.

Wine is the fountain of wealth and the staple export of Portugal. The exports of fermented liquors in 1856-57 attained a computed value of £1,653,456, *i. e.*, more than that of all the other classes of exports added together. The vine disease appeared first in 1852.

The port wine district, or so-called "demarcaçao," is a strictly-defined, narrow strip of land, extending for nine leagues along both banks of the Douro, and containing a population of 64,000. No other wine than the approved wine of this small district can legally be shipped from Oporto. It was formerly divided into three sub-districts, called Feitoria, Sub-

sidiario, and Ramo. The produce of the first alone was allowed to be exported to Europe. In 1852 they were all three agglomerated into one "demarcaçao." The legal distinctions were abolished, but the prime wines are still grown in the Feitoria.

Immediately after the vintage, the officers of the "Commissao Reguladora" visit every farm, in order to "enrol" and sample the wine. They carry away a sealed sample-bottle of every pipe, with the name of the grower pasted on it in such a manner as not to be visible till after the label is detached. At the fair of Pezo de Regoa, in February, the samples are all tried by jury; those "approved" for export received a "bilhete," or pass of admission to the export warehouse of Villa Nova. Here alone the approved wines can be stored.

To be "approved," Douro wine must possess certain qualities which the grape-juice alone cannot impart. It must contain body, sweetness, and color enough to qualify it for "benefitting" other wines; or, in the words of the law, "para si e para dar." This disposition is founded on a notion that port is required by us principally for blending with other wines. This has led to the production of that artificial, thick, strong, and sweet compound in such great demand for tavern use in England. A simple unloaded wine cannot lawfully receive a "bilhete," but must be shipped under a purchased one. As these "bilhetes" are objects of sale, the more delicate wines used to be passed by this means. The minimum of adventitious spirit in port wine shipped to England is 2½ per cent., but the heavy, full-bodied, so-called rich wines, cannot ever contain less than 15 to 17 gallons per pipe of 115 gallons.

The crop of 1851 (94,122 pipes) was equal, in quantity and quality, to any on record. That of 1852 was still very large. That of 1853 was the first attacked by the *oidium*, but was little, if at all, below an average. Those of 1854 and 1855 first showed any real falling off. That of 1856 was the shortest on record (14,673 pipes).

The enrolment of 1858 closed with a figure of 17,353 pipes; but it is necessary to state that 4,600 are Ramo wines, a produce formerly not exportable at all, and that a part of the remainder is not grown in the "demarcaçao" at all.

Wines, like those of the vintage, must, of course, require a more than average proportion of alcohol. This used to be supplied by the distillation of the "consumo" wine; but the latter now finds a more profitable market in the tavern supply. Native wine-brandy was till last September alone admissible to the Villa Nova stores for the purpose of blending with the export wines. Much Spanish brandy, however, has found its way thither. Fig-brandy has also been surreptitiously introduced. By a Decree of September, 1858, foreign spirits "that shall be considered fit" may be admitted there for the above purpose.

The value of port wine seems to have doubled since the year 1848, if the official Returns are to be credited, for in that year it was valued at $84.000 per pipe, and in 1859 at $171.000. The prices paid to the farmer for wines in a crude state without brandy have been;—

In 1855,	from	$48,000	to	$72,000
1856,	"	50,000	to	80,000
1857,	"	65,000	to	100,000
1858,	"	45,000	to	60,000
1859,	"	60,000	to	80,000

The export of this wine did not sensibly diminish till 1857–58, when it fell off suddenly in quantities and value. The large stocks in hand have done much to mitigate the shock caused by the long-continued failures of wine. These stocks at Villa Nova amounted on the 1st January, 1856, to 98,776 pipes, and last June, 1859, to 77,582 pipes. These deposits are for the greatest part unfit for the English market. Those which (according to the vitiated taste of the day) are considered of the best description are mostly adulterated to such an extent with elderberry, geropiga, and other ingredients, that it would be difficult to procure 20,000 pipes of pure wine among the whole quantity offered for sale. These stocks must, however, be got rid off. The shipments of late years have already had a tendency, by their inferior character, to throw discredit upon all shipments, however excellent, bearing the name of port, and to depreciate the character of the whole stock. Notwithstanding the Government guarantee of quality, fresh supplies of crude ill-fermented wines have been annually thrown into Villa Nova.

LISBON AND MADEIRA WINES.

Brazil is the greatest market for the Lisbon wines. Madeira wine is no longer produced, the year 1858 yielding only 600 pipes of inferior wine. For six years there was no vintage whatever, the *oidium* having destroyed the grape. The wine was replaced by the sugar cane. It is worthy of note that Madeira wine is counterfeited on a large scale in France, and even in Lisbon. The common "Dry Lisbon" can by a certain process of heating and storing be made to acquire a resemblance to the "East Indian Maderia."

EFFECTS OF THE VINE DISEASE.

In summing up the effects of the vine disease, it will be found that this visitation has annihilated the most expensive Portuguese wine, has reduced the annual crop of the others to a quarter of an average, has impaired the quality of this remnant and its credit in its best markets; that it has already begun to diminish the value of exports, and, as a natural consequence, has evidently checked the expansion of the import trade, which had been before advancing so rapidly. It has also caused a serious commercial crisis at Oporto, and has certainly crippled the national revenue.

CHEMICAL HISTORY OF A CANDLE.

By M. Faraday, D.C.L., F.R.S.

From the Chemical News Jan. 5th 1861.

Lecture I.—*A Candle: The Flame—Its Sources—Structure—Mobility—Brightness.*

I purpose thanking you for the honor you do us in coming to see what are our proceedings here, by bringing before you the Chemical History of a Candle. I have done so on a former occasion, and if I had my own will I should do it almost every year; so abundant is the interest that attaches itself to the subject, so wonderful are the varieties of outlet which it gives into the various departments of philosophy. There is not a law under which any part of this universe is governed which does not come into play and is touched upon in these phenomena. There is no better, there is no more open door by which you can enter into the study of natural physical philosophy, than by considering the phenomena of a candle.

Therefore I believe I shall not dissapoint you in choosing this for my subject rather than any newer form, which could not be better, if it were so good.

And having said so much to you, let me say this also: that though our subject be so great, and our intention that of treating it honestly, philosophically, and seriously, yet I mean to pass away from all those here who are seniors. I claim the right of speaking to juveniles as a juvenile myself. I have done it on former occasions, and, if you please, I shall do it again. And though I know that I stand here with the knowledge of having the words I utter given to the world, yet that shall not deter me from speaking in the same familiar way to those whom I esteem nearest to me on this occasion. You know that though we make no publication of our proceedings—neither I nor the authorities—we give all facilities to those who honor us by supposing that what they hear here is worth conveying farther—we give them every facility to hear us, and write about us, but it is entirely their own act. You have here the original, in whatever shape it appears anywhere else.

And now to my boys and girls.

I must first tell you what candles are made of. Some are very curious things. I have here some bits of timber, branches of trees particularly famous for their burning. And here you see a piece of that very curious substance taken out of some of the bogs in Ireland, called *candle wood*, a hard, strong, excellent wood, evidently fitted for good work as a resister of force, and yet withal burning so well that when it is found they make splinters of it, and torches, since it burns like a candle, and burns very well indeed. And here in this wood is one of the most beautiful illustrations of the general nature of a candle that I can possibly give. The fuel provided, the means of bringing that fuel to the place of chemical action, the regular and gradual supply of air to that place of action—heat and light—all produced by a little piece of wood of this kind, forming, in fact a natural candle.

But we must speak of candles as they are in commerce. Here are a couple of candles commonly called dips. They are made of lengths of cotton cut off, hung up by a loop, dipped into melted tallow, taken out again and cooled, then redipped, until there is an accumulation of tallow round the cotton. In order that you may have an idea of the various characters of these candles, you see these which I hold in my hand—they are very small and very curious. They are, or were, the candles used by the miners in coal mines. In olden times the miners had to find their own candles, and it was supposed that a small candle would not so soon set fire to the fire-damp in the coal mines as a large one; and for that reason, as well as for economy's sake, they had candle's made of this sort, 20, 30, 40, or 60, to the pound. They have been replaced since then by the steel-mill, and then by the Davy-lamp, and other safety-lamps of various kinds. I have here a candle that was taken out of the *Royal George*, it is said, by Sir George Pashley. It has been sunk in the sea for many years, subject to the action of salt water. It shows you how well candles may be preserved, for though it is cracked about and broken a good deal, yet when lighted it goes on burning regularly, and the tallow resumes its natural condition, as soon as it is fused.

Mr. Field, of Lambeth, has supplied me abundantly with beautiful illustrations of the candle and its materials: I shall therefore now refer to them. And, first, there is the suet—the fat of the ox—Russian tallow, I believe, employed in the manufacture of these dips, which Gay Lussac, or some one who entrusted him with his knowledge, converted into that beautiful substance, stearine, which you see lying beside it. A candle, you know, is not now a greasy thing like an ordinary tallow candle, but a clean thing, and you may almost scrape off and pulverise the drops which fall from it without soiling anything. This is the process he adopted:—The fat or tallow is first boiled with quick lime, and made into a soap, and then the soap is decomposed by sulphuric acid, which takes away the lime, and leaves the fat rearranged as stearic acid, whilst a quantity of glycerine is produced at the same time. Glycerine—absolutely a sugar, or a substance similiar to sugar—comes out of the tallow in this chemical change. The oil is then pressed out of it; and you see here this series of pressed cakes, showing how beautifully the impurities are carried out by the oily part as the pressure goes on increasing, and at last you have left that substance which is melted, and cast into candles as you here see them. The candle I have in my hand is a stearine candle, made of stearine from tallow in the way I have told you. Then here is a sperm candle, which comes from the purified oil of the spermaceti whale. Here also is yellow beeswax and refined beeswax, from which candles are made. Here, too, is that curious substance called paraffin obtained from the bogs of Ireland. I have here also a substance brought from Japan since we have forced an entrance into that out-of-the-way place—a kind of wax which a kind friend has sent me, and which forms a new material for the manufacture of candles.

And how are these candles made? I have told you about dips, and I will show you how moulds are made. Let us imagine any of these candles to be made of materials which can be cast. "Cast!" you say, "Why a candle is a thing that melts, and surely if you can melt it you can cast it." No so. It is wonderful, in the progress of manufacture, and in the consideration of the means best fitted to produce the required result, how things turn up which one would not expect beforehand. Candles cannot always be cast. A wax candle can never be cast. It is made by a particular process which I can illustrate in a minute or two, but I must not spend much time on it. Wax is a thing which, burning so well, and melting so easily in a candle cannot be cast. However, let us take a material that can be cast. Here is a frame with a number of moulds fastened in it. The first thing to be done is to put a wick through them. Here is one—a plaited wick, which does not require snuffing—supported by a little wire. It goes to the bottom, where it is pegged in—the little peg holding the cotton tight and stopping the aperture, so that nothing fluid shall run out. At the upper part there is a little bar placed across, which stretches the cotton and holds it in the mould. The tallow is then melted, and the moulds are filled. After a certain time, when the moulds are cool, the excess of tallow is poured off at one corner, and then cleaned off altogether, and the ends of the wick cut away. The candles alone then remain in the mould, and you have only to upset them, as I am doing, when out they tumble, for the candles are made in the form of cones, being narrower at the top than at the bottom, so that what with their form and their own shrinking, they only need a little shaking, and out they fall. In the same way are made these candles

of stearine and of paraffin. It is a curious thing to see how wax candles are made. A lot of cottons are hung upon frames, as you see here, and covered with metal tags at the ends, to keep the wax from covering the cotton in those places. These are carried to a heater, where the wax is melted. As you see, the frames can turn round, and as they turn a man takes a vessel of wax and pours it first down one, and then the next, and the next, and so on. When he has gone once round, if it is sufficiently cool, he gives the first a second coat, and so on until they are all of the required thickness. When they have been thus clothed, or fed, or made up to that thickness, they are taken off and placed elsewhere. I have here, by the kindness of Mr. Field, several specimens of these candles. Here is one only half finished. They are then taken down and well rolled upon a fine stone slab, and the conical top is moulded by properly shaped tubes, and the bottoms cut off and trimmed. This is done so beautifully, that they can make candles in this way weighing exactly four, or six, to the pound, or any number you please.

We must not, however, take up more time about the mere manufacture, but go a little further into the matter. I have not yet referred you to luxuries in candles (for there is such a thing as luxury in candles). See how beautifully these are coloured; you see here mauve, Magenta, and all the chemical colours recently introduced, applied to candles. You observe also, different forms employed. Here is a fluted pillar most beautifully shaped; and I have also here some candles sent me by Mr. Pearsall, which are ornamented with designs upon them, so that as they burn, you have as it were a glowing sun above and and a bouquet of flowers beneath. All, however, that is fine and beautiful, is not useful. These fluted candles, pretty as they are, are bad candles, they are bad because of their external shape. Nevertheless, I show you these specimens sent to me from kind friends on all sides, that you may see what is done and what may be done in this or that direction, though, as I have said, when we come to these refinements, we are obliged to sacrifice a little in utility.

Now as to the light of the candle. We will light one or two, and set them at work in the performance of their proper functions. You observe a candle is a very different thing from a lamp. With a lamp you take a little oil, fill your vessel, put in a little moss or some cotton prepared by artificial means, and then light the top of the wick. When the flame runs down the cotton to the oil, it gets extinguished, but it goes on burning in the part above. Now, I have no doubt you may ask, how is it that the oil which will not burn of itself gets up to the top of the cotton where it will burn! We shall presently examine that; but there is a much more wonderful thing about the burning of a candle than this. You have here a solid substance with no vessel to contain it, and how is it that this solid substance can get up to the place where the flame is? How is it that this solid gets there, it not being a fluid? or, when it is made a fluid, then how is it that it keeps together? This is a wonderful thing about a candle.

We have here a good deal of wind, which will help us in some of our illustrations, but tease us in others; for the sake therefore, of a little regularity, and to simplify the matter, I shall make a quiet flame, for who can study a subject when there are difficulties in the way not belonging to it? Here is a clever invention of some costermonger or street stander in the market-place for the shading of their candles on Saturday nights, when they are selling their greens, or potatoes or fish. I have very often admired it. They put a lamp-glass round the candle, supported on a kind of gallery, which clasps it, and it can be slipped up and down as required. By the use of this lamp-glass, employed in the same way, you have a steady flame, which you can look at, and carefully examine, as I hope you will do, at home.

You see then, in the first instance, that a beautiful cup is formed. As the air comes to the candle it moves upwards by the force of the current which the heat of the candle produces, and it so cools all the sides of the wax, tallow, or fuel, as to keep the edge much cooler than the part within; the part within melts by the flame that runs down the wick as far as it can go before it is extinguished, but the part on the outside does not melt. If I made a current in one direction, my cup would be lop sided, and the fluid would consequently run over,—for the same force of gravity which holds worlds together holds this fluid in a horizontal position, and if the cup be not horizontal, of course the fluid will run away in guttering. You see, therefore, that the cup is formed by this fine, uniform, regular ascending current of air upon all sides which keeps the exterior of the candle cool. No fuel would do for a candle which has not the property of giving this cup, except such fuel as the Irish bogwood, where the thing is like a sponge, and holds its own fuel. You see now, why you would have had such a bad result if you were to burn these beautiful candles that I have shown you, which are irregular, intermittent in their shape, and cannot, therefore, have that nicely-formed edge to the cup which is the great beauty in a candle. I hope that you will now see that the perfection of a process, that is, its utility, is the better point of beauty about it. It is not the best-looking thing, but the best-acting thing, which is the most advantageous to us. This good-looking candle is a bad burning one. There will be a guttering round about it because of the irregularity of the stream of air and the badness of the cup which is formed thereby. You may see some pretty cases (and I expect you to think of these things) of the action of the ascending currents when you have a little gutter run down the side of a candle, making it thicker than it is elsewhere. As the candle goes on burning, that keeps its place and forms a little pillar sticking up by the side, because, as it rises higher above the rest of the wax or fuel the air gets round it, it is more cooled and better resists the action of the heat at a little distance. Now, the greatest mistakes and faults with regard to candles, as with regard to other points, often bring with them instruction which we should not receive if they had not occurred. We come here to be philosophers, and I hope you will always remember that whenever a result happens, especially if it is new, you should say, "What is the cause? Why does that occur?" and you will in the course of time find it out.

Then there is another point about these candles which will answer a question,—that is, as to the way in which this fluid gets out of the cup, up the wick, and into the place of combustion. You know that the flames on these wicks burning in candles made of beeswax, or stearine, or spermaceti, do not run down to the wax or other matter, and melt it all away, but keep it to their own right place. They are fenced off from the fluid below, and do not encroach on the cup at the sides. I cannot imagine

a more beautiful and more compact thing than the condition of adjustment under which a candle makes one part subserve to the other to the very end of its action. A combustible thing like that, burning away gradually, never being intruded on by the flame,—is a very beautiful sight; especially when you come to learn what a vigorous thing flame is—what power of destroying the wax itself when it gets hold of it, and destroying its proper form even before it gets hold of it, if it come too near.

Now, how does it get hold of it? There is a beautiful point about that—*capillary attraction.* "Capillary attraction!" you say,—"the attraction of hairs." Well, never mind the name; it was given in old times before we had a good understanding of what the real power was. It is by what is called capillary attraction that the fuel is conveyed to the part where combustion goes on, and is deposited there, not in a careless way, but very beautifully in the very midst of the centre of action, which takes place around it. Now I am going to give you one or two instances of capillary attraction. It is that kind of action or attraction which makes two things that do not dissolve in each other still hold together. When you wash your hands you wet them thoroughly; you take a little soap to make the adhesion better, and you find your hand remains wet. This is by that kind of attraction of which I am about to speak. And what is more; if your hands are not soiled (as they almost always are by usages of life), if you put your finger into a little warm water, the water will creep a little way up the finger, though you may not stop to examine it. I have here a substance which is rather porous—a column of salt,—and I will pour into the plate at the bottom, not water as it appears, but a saturated solution of salt, which cannot absorb more; so that the action which you see, will not be due to its dissolving anything. We may consider the plate to be the candle, and the salt the wick, and this solution the melted tallow. (I have coloured the fluid that you may see the action better.) You observe that now I pour in the fluid, it rises and gradually creeps up the salt higher and higher; and provided the column does not tumble over, it will go to the top. If this blue solution were combustible, and we were to place a wick at the top of the salt, it would burn as it entered into the wick. It is a most curious thing to see this kind of action taking place, and to observe how singular some of the circumstances are about it. When you wash your hands you take a towel to wipe off the water, and it is by that kind of wetting, or that kind of attraction which makes the towel become wet with water, that the wick is made wet with the tallow. I have known some careless boys and girls (indeed, I have known it to happen to careful people as well) who, having washed their hands and wiped them with a towel, have thrown the towel over the side of the basin, and before long it has drawn all the water out of the basin and conveyed it to the floor, because it happened to be thrown over the side in such a way as to serve the purpose of a syphon. That you may the better see the way in which the substances act one upon another, I have here a vessel made of wire gauze filled with water, and you may compare it in its action to the cotton in one respect, or to a piece of calico in the other. In fact, wicks are sometimes made of a kind of a wire gauze. You will observe that this vessel is a porous thing, for if I pour a little water on the top, it will run out at the bottom. You would be puzzled for a good while if I asked you what the state of the vessel is, what is inside it, and why it is there? The vessel is full of water, and yet you see the water goes in and runs out as if it were empty. In order to prove this to you I have only to empty it. The reason is this—the wire being once wetted, remains wet; The meshes are so small that the fluid is attracted so strongly from the one side to the other, as to remain in the vessel although it is porous. In like manner the particles of melted tallow ascend the cotton and get to the top; other particles then follow by their mutual attraction for each other, and as they reach the flame they are gradually burned.

Here is another application of the same principle. You see this bit of cane. I have seen boys about the streets, who are very anxious to appear like men, take a piece of cane and light it and smoke it, as an imitation of a cigar. They are enabled to do so by permeability of the cane in one direction, and by its capillarity. If I place this piece of cane on a plate containing some camphine (which is very much like paraffin in its general character), exactly in the same manner as the blue fluid rose through the salt, will this fluid rise through the piece of cane. There being no pores at the side, the fluid cannot go in that direction, but must pass through its length. Already the fluid is at the top of the cane, and now I can light it and form it into a candle. The fluid has risen by the capillary attraction of the piece of cane, just as it does through the cotton in the candle.

Now, the only reason why the candle does not burn all down the side of the wick is that the melted tallow extinguishes the flame. You know that a candle if turned upside down, so as to allow the fuel hot enough to burn, as it does above where it is carried in small quantities into the wick, and has all the effect of the heat exercised upon it.

There is another condition which you must learn as regards the candle, without which you would not be able fully to understand the philosophy of it, and that is the vaporous condition of the fuel. In order that you may understand that, let me show you a very pretty, but very common-place experiment. If you blow a candle out cleverly, you will see the vapour rise from it. You have, I know, often smelt the vapour of a blown-out candle, and a very bad smell it is; but if you blow it out cleverly, you will be able to see pretty well the vapour into which this solid matter is transformed. I will blow out one of these candles in such a way as not to disturb the air around about it by the continuing action of my breath; and now, if I hold a lighted taper two or three inches from the wick, you will observe a train of fire going through the air till it reaches the candle.

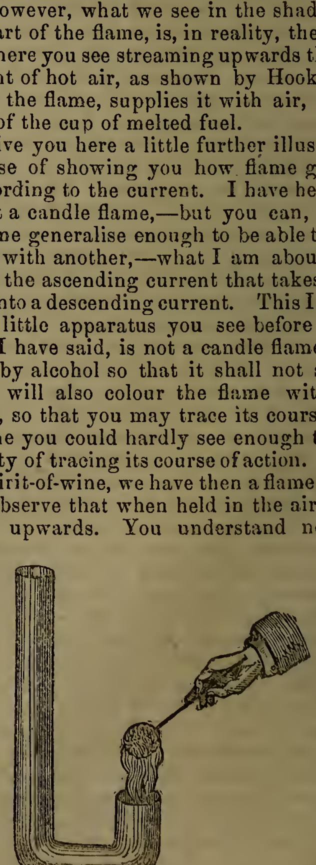
I am obliged to be quick and ready, because if I allow the vapour time to cool, it becomes condensed into a liquid or solid, or the stream of combustible matter gets disturbed.

Now, as to the shape or form of the flame, it concerns us much to know about the condition which the matter of the candle finally assumes at the top of the wick, where you have such beauty and brightness as nothing but combustion or flame can produce. You have the glittering beauty of gold and silver, and the still higher lustre of jewels like the diamond and ruby ; but nothing of these comes by comparison near to the brilliancy and beauty of flame. What diamond can shine like flame ? It owes its lustre at night time to the very flame shining upon it. The flame shines in darkness, but the light which the diamond has is as nothing, until the flame shine upon it, when it is brilliant again. The candle alone shines by itself, and for itself, or for those who have arranged the materials. Now, let us look a little at the form of the flame as you see it under the glass shade. It is steady and equal, and its general form is that which is represented in the diagram, varying with atmospheric disturbances, and also varying according to the size of the candle. It is a bright ob-

long, brighter at the top than towards the bottom, with the wick in the middle, and besides the wick in middle certain darker parts towards the bottom where the ignition is not so good as in the part above. I have a drawing here made many years ago by Hooker, when he made his investigations. It is the drawing of the flame of a lamp, but it will apply to the flame of a candle. The cup of the candle is the vessel or lamp ; the melted spermaceti is the oil ; and the wick is common to both. Upon that he sets this little flame, and then he represents what is true, a certain quantity of matter rising about it which you do not see, and which, if you have not been here before, or are not familiar with the subject, you will not know of. He has here represented the parts of the surrounding atmosphere that are very essential to the flame and that are always present with it. There is a current formed, which draws the flame out, for the flame which you see is really drawn out by the current, and drawn upward to a great height, just as Hooker has here shown you by that prolongation of the current in the diagram. You may see this by taking a lighted candle, and putting it in the sun so as to get its shadow thrown on a piece of paper. What a remarkable thing it is that that thing which is light enough to produce shadows of other objects, can be made to throw its own shadow on a piece of white paper or card, so that you can actually see streaming round the flame something which is not part of the flame, but is ascending and drawing the flame upwards. Now I am going to imitate the sunlight, by applying the voltaic battery to the electric lamp. You now see our sun, and its great luminosity ; and by placing a candle between it and the

screen, we get the shadow of the flame. You observe the shadow of the candle, and of the wick ; then there is a darkish part, as represented in the diagram, and then a part which is more distinct. Curiously enough, however, what we see in the shadow as the darkest part of the flame, is, in reality, the brightest part, and here you see streaming upwards the ascending current of hot air, as shown by Hooker, which draws out the flame, supplies it with air, and cools the sides of the cup of melted fuel.

I can give you here a little further illustration for the purpose of showing you how flame goes up or down according to the current. I have here a flame, —it is not a candle flame,—but you can, no doubt, by this time generalise enough to be able to compare one thing with another,—what I am about to do is to change the ascending current that takes the flame upwards into a descending current. This I can easily do by the little apparatus you see before me. The flame, as I have said, is not a candle flame, but it is produced by alcohol so that it shall not smoke too much. I will also colour the flame with another substance, so that you may trace its course, for with spirit alone you could hardly see enough to have the opportunity of tracing its course of action. By lighting the spirit-of-wine, we have then a flame produced, and you observe that when held in the air it naturally goes upwards. You understand now easily



enough why flames go under ordinary circumstances —it is because of the draught of air by which the

combustion is formed. But now by blowing the flame down you see I am enabled to make it go downwards into this little chimney, the direction of the current being changed. Before we have concluded this course of lectures we shall show you a lamp in which the flame goes up, and the smoke goes down, or the flame goes down and the smoke goes up. You see, then, that we have the power in this way of varying the flame in different directions.

There are now some other points that I must bring before you. Many of the flames you see here vary very much in their shape by the current of air blowing around them in different directions; but we can, if we like, make flames so that they will look like fixtures, and we can photograph them—indeed, we have to photograph them—so that they become fixed to us, if we wish to find out everything concerning them. That, however, is not the only thing I wish to mention. If I take a flame sufficiently large, it does not keep that homogeneous, that uniform condition of shape, but it breaks out with a power of life which is quite wonderful. I am about to use another kind of fuel, but it is truly and fairly representative of the wax or tallow of a candle. I have here a large ball of cotton, which will serve as a wick. And, now that I have immersed it in spirit and lit it, in what way does it appear to differ from an ordinary candle? Why it differs very much in one respect, that we have a vivacity and power about it, a beauty and a life utterly unlike the light presented by a candle. You seen those fine tongues of flame rising up. You have the same general disposition of the mass of the flame from below upwards, but, in addition to that, you have this remarkable breaking out into tongues which you do not perceive in the case of a candle. Now, why is this? I must explain it to you, because when you understand that perfectly you will be able to follow me better in what I have to say hereafter. I suppose some here will have made for themselves the experiment I am going to show you. Am I right in supposing that anybody here has played at snapdragon? I do not know a more beautiful illustration of the philosophy of flame, as to a certain part of its history, that the game of snapdragon? First, here is my dish; and let me say, that when you play snapdragon well you ought to have the dish well warmed; you ought also to have warm plums, and warm brandy, which, however, I have not got. When you have put the spirit into your dish, you have the cup and the fuel; and are not the raisins acting like the wicks? I now throw the plums into the dish, and light the spirits, and you see those beautiful tongues of flame that I have referred to. You have the air creeping in over the edge of the dish forming these tongues. Why? Because through the force of the current, and the irregularity of the action of the flame, it cannot flow in one uniform stream. The air flows in so irregularly that you have, what would otherwise be a single image, broken up into a variety of forms, and each of these little tongues has an independent existence of its own. Indeed, I might say, you have here a multitude of independent candles. You must not imagine that because you see these tongues all at once that the flame is of this particular shape. A flame of that shape is never so at any one time. Never is a body of flame, like that which you just saw rising from the ball, of the shape it appears to you. It consists of a multitude of different shapes, succeeding each other so fast that the eye is only able to take cognizance of them all at once. In former times, I purposely analysed a flame of that general

character, and this shows you the different parts of which it is composed. They do not occur all at once; it is only because we see these shapes in such rapid succession, that they seem to us to exist all at one time.

It is too bad that we have not got further than my game of snapdragon, but we must not, under any circumstances, keep you beyond your time, It will be a lesson to me in future to hold you more strictly to the philosophy of the thing than to take up your time so much with these illustrations.

The Board of Arts & Manufactures
FOR UPPER CANADA.

PROCEEDINGS OF THE SUB-COMMITTEE.

Thursday, Feb. 28th, 1861.

The first meeting of the Sub-Committee for the current year was held at the Board Room, at one o'clock, p. m.; Present—The Vice President (Mr. J. E. Pell), Professor Hincks, Professor Hind, W. Hay, Esq., Dr. Craigie, and T. Sheldrick.

Minutes of the last annual meeting were submitted.

The Secretary read correspondence with the Society of Arts, in relation to books and periodicals ordered by the Board; also a communication from Messrs. Maw & Co., of England, notifying their having forwarded for the library of the Board copies of their pattern books of tesselated pavement, and of their intended donation to the museum of the Board of framed examples of their manufactures, shewing the effect of their complete pavement when laid; from the Smith's Falls Mechanics' Institute, enclosing the sum of $8, as its subscription to this Board for the current year; also a correspondence with the Board of Arts and Manufactures for Lower Canada, in relation to its securing an interest in the Journal published by this Board; to the World's Exhibition, proposed to be held in London in the year 1862; on amendments to the acts constituting these Boards, and other matters.

The Secretary stated that, after consulting with the President and some members of the Sub-Committee, he had made an informal offer of arrangement with the Board for Lower Canada, to publish

its transactions, and to supply a certain number of copies of the Journal to said Board, on its becoming responsible for a stated proportion of the expenses connected with its publication. This proposed arrangement has been so far completed that it only awaits the confirmation of this Committee to bring it into effect.

A statement of the probable Receipts and Expenditure of this Board for the current year, was also submitted.

The Secretary reported that he had corresponded with some of the principal booksellers in Great Britain and the United States, soliciting the regular transmission to this Board of their latest catalogues of books, for the use not only of the Board but the public generally; that Messrs. Harper Brothers and D. Appleton & Co., have sent on their latest publications, and that the catalogues of many other publishers may be shortly expected.

Sundry accounts were passed and ordered to be paid; it was then

Resolved, That this Committee approve of the offer of arrangement made by the Secretary to the Lower Canada Board in relation to the Journal, and authorise its completion on the terms proposed.

Resolved, That books be appropriated to the Smith's Falls Mechanics' Institute to the value of its subscription to this Board for the current year.

Resolved, That the Secretary be instructed to effect an insurance on the books and furniture belonging to the Board, to the amount of $1000.

Resolved, That Professor Hind, W. Hay, Esq., and the Secretary, do constitute the Book Committee for the current year.

Resolved, That the sum of $250 be appropriated for the purchase of books of reference, and that said amount be placed at the disposal of the Book Committee.

Resolved, That W. Hay, Esq., Dr. Craigie, Professor Hincks, and Professor Hind, do constitute the Journal Committee for the current year.

Resolved, That the Secretary be instructed to address circulars to the Presidents of the several Mechanics' Institutes in Upper Canada, requesting them to appoint, on behalf of this Board, canvassers for the Journal in their respective localities; and also to request that the managers of these Institutions would endeavour to secure as wide a circulation of the Journal as possible amongst their members.

Resolved, That the President, the Vice President, and the Secretary, be appointed a Special Committee on Amendments to the Act Constituting this Board, and on the Patent Law Amendment Act.

Resolved, That the Vice President, Professor Hind, Professor Hincks, and W. Hay, Esq., be a Special Committee to draft a series of suggestions in relation to the International Exhibition of 1862, and to report to the Committee at its next meeting.

Resolved, That the Secretary be instructed to inform the Sub-Committee of the Lower Canada Board of the appointment of the last named Committee, and to request information as to what has been done by said Board in relation thereto.

Resolved, That this Committee adjourn till Thursday, the 14th of March, to receive the report of the Special Committee on the International Exhibition, and for other business.

W. Edwards, *Secretary*.

Members of Mechanic's Institutes, and of other public bodies, subscribing for this Journal through their respective Societies, will have their copies addressed to them direct from the office of the Board.

The Free Library of Reference, and Model Rooms, are open to the public daily, from 10 a.m. till noon, and from 1 to 4 o'clock, p.m., at the Board Room, No. 79 King Street West, Toronto.

The regular meetings of the Sub-Committee of the Board are held on the last Thursday of each month.

The Board of Arts & Manufactures
FOR LOWER CANADA.

PROCEEDINGS OF THE BOARD.

Board Rooms, Mechanics' Hall,
Montreal, 8th January, 1861.

The Board met this day according to adjournment at three o'clock P. M.

Present:—Dr. Dawson, President, in the chair, the Vice-President, Messrs. Rodden, Bartley, Murray, Perry, Bulmer, Munro, Stevenson, Bertram, and Lyman.

The minutes of the last meeting were read and confirmed.

A letter was read from W. Rodden, & Co., in reference to the action taken on their letter of the 10th October last, and after some discussion,

It was moved by A. Stevenson, seconded by H. Lyman:—That the letter be received, and the Secretary be authorised to write to Messrs. Rodden, & Co., giving them the necessary explanations of the previous action of the Sub-committee.

The acting Secretary then read the quarterly report of the Sub-committee, as follows:—

Board Rooms, Mechanics' Hall,
Montreal, 28th Dec., 1860.

The Sub-committee of the Board of Arts and Manufactures for Lower Canada, have the honour to report to the Board:—

Since the last Quarterly Meeting your Sub-committee have been engaged principally in arranging the accounts of the Exhibition, and of the building, and in securing the latter for the winter.

The Building Committee has presented a final report on the contract for the building, showing a balance of $11,428 85, which will be due on the completion of certain parts mentioned in a schedule attached to the report. This report is herewith submitted, and it is recommended that a mortgage for $11,000 be given to the contractor, and that the sum of $428.85, be paid on completion of the work above mentioned. These sums to be in full of all claims of the contractor.

The accounts of the Exhibition itself have for the most part been paid, and it is hoped that the Sub-committee will very soon be able to present a complete general statement of the whole expenses.

With respect to the future operations of the Board, the following subjects have engaged the attention of your Sub-committee, and are recommended to the attention of their successors.

1st. The pressing on the Government of the claims which the Board can now put forth to an increase of the annual grant, adequate to the due maintenance of its operations.

2nd. The organizing, in conjunction with the Upper Canada Board, of an Exhibition preparatory to that to be held in London in 1862, and the securing of means for that purpose.

3rd. The opening of the building as early as possible in the spring, as a museum of the industrial resources of the country, and the securing in this the co-operation of Government, of Public Boards and Departments, and of Manufacturers.

4th. The transference to the building of the Board of its Office and Library, and in connection with this the provision of adequate means for heating it during winter.

5th. The extending of aid to evening classes in connection with Mechanics' Institutes, and especially to that now in active operation in connection with the Montreal Institute.

6th. A course of Popular Lectures. A special committee has been appointed on this subject, and it seems probable that a course of six to ten lectures can be commenced about the end of the present month.

7th. The issue of a periodical publication devoted to Arts and Manufactures has often engaged the attention of the Sub-committee, but hitherto the pressure of other duties has prevented its being seriously entertained. We observe with much pleasure, that the initiative in this most important matter has been taken by the Upper Canada Board, and it is suggested that in the mean time arrangements be made with them for the publication of matters relating to this Board, and their circulation in Lower Canada.

In conclusion, your Sub-committee would remark, that the great enterprise of providing an adequate Exhibition to represent the manufacturing interests of Canada, on the occasion of the visit of his Royal Highness, the Prince of Wales, has taxed to the utmost the resources of the Board, and demanded an expenditure of time and labour which they trust will not be required of their successors. Notwithstanding the many shortcomings inevitable in such an undertaking, with so limited time and means, your Sub-committee believe that a result so creditable and satisfactory could not have been secured otherwise than through a Board of this nature, and they trust that the Board has earned a claim to the gratitude and confidence of the country, and has provided facilities for its future labours, which will enable it in the coming year to advance rapidly towards the full attainment of the important objects for which it was instituted.

The whole respectfully submitted.

It was moved by H. Lyman, seconded by H. Munro.—That the report be received and considered.—*Carried.*

After discussion upon some of the details of the report, it was moved by A. Perry, seconded by H. Lyman :—That the report under consideration be adopted. *Carried;* seven for and three against the motion.

The President of the Montreal Mechanics' Institute sent in a duly certified list of 440 mechanic members, and a certificate of the election of the following delegates to represent that Institute at this Board for the year 1861, viz : William Rodden, H. Bulmer, W. P. Bartley, Dunbar Browne, Robert Forsyth, N. B. Corse, A. A. Stevenson, Jonathan Findlay, Alfred Perry, James Shearer, B. Chamberlin, William Rutherford, A. Cantin, Henry Lyman, A. Ramsay, P. McQuestin, John Wood, John Redpath, Alex. Murray, Alex. Bertram, Geo. A. Drummond, E. E. Gilbert.

It was moved by Mr. Rodden, seconded by Mr. Bartley :—That the returns of the Mechanics' Institute be received, and placed on record.—*Carried.*

The Board then proceeded to the election of Office-bearers and Sub-committee, for the year 1861.

Messrs. Browne and Stevenson were named as scrutineers.

On the ballot for President being taken, sixteen votes were cast, of which twelve were for J. Redpath, Esq., who was declared duly elected.

On the ballot for treasurer being taken, sixteen votes were cast, of which twelve were for W. Rodden, Esq., who was declared duly elected.

On the ballot for treasurer being taken, sixteen votes were cast, of which fourteen were for N. B. Corse, Esq., who was declared duly elected.

On the ballot for Secretary being taken, 15 votes were cast, of which 14 were for B. Chamberlin, Esq., who was declared duly elected.

On the ballot for the Sub-Committee being taken, 14 votes were cast, which stood as follows:—For Professor J. W. Dawson, 14; Messrs. A. A. Stevenson and H. Bulmer, 13 each; A. Murray, 12; R. Forsyth, N. B. Corse, B. Chamberlin, 10 each; H. Lyman and Dunbar Browne, 9 each; and the above-named gentlemen were declared duly elected.

Messrs. H. Munro and R. Forsyth were unanimously appointed Auditors for the year.

It was moved by J. Wood, seconded by J. Findlay:—That the thanks of the Board are due, and are hereby tendered to the retiring President, Officers and Committee, for their valuable services during the past year.—*Carried.*

Mr. Wood gave notice that at the next regular meeting of the Board, he would move that an amendment be made to the By-laws, to the effect that at all meetings of the Board, nine members shall form a quorum.

It was moved by H. Bulmer, seconded by W. P. Bartley:—That the President and Secretary be authorized to sign a mortgage in favor of the Contractor for the Exhibition Building, (D. McNiven,) for the sum of eleven thousand dollars, on the conditions and in accordance with the report of the Sub-Committee of the late Board just adopted, and that the mortgage be for a period of not less than two years, and bearing interest at the rate of seven per cent. per annum.—*Carried.*

It was moved by Professor Dawson, seconded by H. Lyman:—That the Sub-Committee be instructed to take immediate action in conjunction, if possible, with the Upper Canada Board, in reference to the passing of Amendments to the Act constituting the Board, proposed in the last Session of the Legislature, and especially for giving to the Board an independent position.—*Carried.*

It was moved by D. Browne, seconded by A. Murray:—That the Board stand adjourned to the 11th February.—*Carried.*

The meeting then adjourned.

B. Chamberlin,
Secretary.

Montreal, 11th February, 1861.

The Board met according to adjournment, this day, at three o'clock, P. M.

The Secretary read the following Report from the Sub-Committee:—

The Sub-Committee have to report—That the accounts for the past year have been audited and found correct, but the auditors have submitted some suggestions with respect to the vouchers to be used in future, of which the Sub-Committee have approved, and will see them carried into effect.

The Sub-Committee have drafted a report to the Government, respecting the recent Exhibition, which they herewith submit for the approval of the Board.

The accounts with the Contractor for the Exhibition Building, have been finally closed; the mortgage in his favor has been signed as directed, and all the Exhibition accounts, with a very few exceptions, finally settled.

The Committee would suggest that memorials be prepared and forwarded to the Provincial Government and Legislature, urging the need of an increased grant to this Board; the amendment of the law establishing it, in the same manner as prayed for during the last Session of Parliament; for the amendment of the Patent Laws; for a measure of Sanitary Reform, which will secure more healthy homes for the working classes; and that measures be taken to have Canada fitly represented at the Great London Exhibition of 1862.

Arrangements have been made for a course of six Free Lectures, to be delivered at the Mechanics' Hall, on Tuesday evenings, to commence on the 19th instant, the course being opened by Principal Dawson.

A Committee has been named to revise the bill to amend and consolidate the Patent Laws, prepared and sanctioned by the Board last year.

It is proposed forthwith to open the Free Library of Reference of the Board, to the public, and to give notice of the fact in the several city papers.

The Sub-Committee is in correspondence with the Upper Canada Board on the subject of the publication of the proceedings of this Board in its journal, and hope to make a favorable arrangement.

The Report was then adopted.

The Secretary read the copy of a letter sent to the Secretary of the Society of Arts, London, respecting the Exhibition of 1862.

A partial report of the Special Committee to revise the Patent Law Amendment Bill, was submitted, whereupon,

Mr. Findlay, seconded by Mr. Ramsay, moved to refer the amendments to the Patent Laws back to the Special Committee, and that members of the Board be given notice and enabled to attend the meetings of such Special Committee.—*Carried.*

Moved by H. Lyman, seconded by Mr. Browne:—That the President and Secretary be authorized to prepare and forward the memorials referred to in the report of the Sub-committee.—*Carried.*

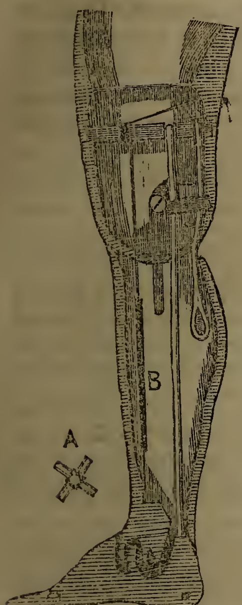
The Secretary read a statement of the receipts and expenditure of the Exhibition and Building Fund.

The meeting then adjourned.

B. Chamberlin,
Secretary.

EDITORIAL NOTICES.

NORRIS BLACK'S IMPROVED ARTIFICIAL LEG WITH AN UNIVERSAL JOINT AT THE ANKLE.



The improvement is upon Mr. Palmer's of Philadelphia, and consists in using the device A, to give motion in all directions to the ankle joint; two arms are embedded lengthwise in the foot; the leg is fitted down on the transverse arms; through the hole in the centre a strong cord passes, that serves to hold the two parts together, this forms the universal joint; the heel-cord, ham-string and plan of the knee joint are similar to Mr Palmer's. Instead of a separate coiled spring controling each joint, an elastic cord B, is placed in the leg, and connected by a strong cord to the foot, in front of the joint; by another cord passing in front of the centre of the knee it is connected with the thigh—this cord passes on to the outside of the thigh, at the back, where it is tied, and may be tightened when necessary. It will be seen that the elastic cord just described, will flex the ankle, and extend the leg perfectly.

The advantages claimed for the improvement are, that the spring is adjustable, does not squeak, and can be replaced when worn out, by the person wearing the limb. The universal joint at the ankle allows the foot to accommodate itself to uneven surfaces—gives more ease to the wearer, and a more natural action to the limb.

PETROLEUM IN GASPÉ.

The importance which the recent discoveries of Petroleum, or Rock Oils, in the United States and Canada is now assuming, may be gathered from the article on this subject which appears in the present issue of the Journal, as well as in the number for February. It may be well to call attention to the fact that Sir William Logan, in his enumeration of Canadian minerals, states that Petroleum is found in the valleys of the River St. Jean and the Ruisseau Argenté of Gaspé. The discovery of a Gaspé rock oil region would give an extraordinary stimulus to the settlement of that peninsula; and it may be remarked that rocks of the same age as those which yield petroleum in parts of Pennsylvania, Ohio, Kentucky and Virginia, are found in Gaspé. It is well to remind those who are attracted by the apparent facilities for realizing wealth by means of Rock Oil, that the wells or springs in Pennsylvania are beginning to show signs of a diminution of yield, and that an unbiassed and wholly uninterested opinion respecting the increase, or continuance even, of the present supply of this material, based on geological grounds, can scarcely be in favour of the expectation that the industry is at all likely to be a growing one in any one locality, but there is every reason to suppose that it will be general and intermittent over wide areas.

BOARD OF ARTS AND MANUFACTURES FOR LOWER CANADA.—FREE LECTURES.

Among the duties prescribed by Law for the guidance of the Boards of Arts and Manufactures in the Province, is the selection of competent lecturers on subjects connected with the Mechanical Arts and Sciences. The Lower Canada Board has recently commenced a course for the present year, and the opening lecture was delivered by Mr. Principal Dawson, on Tuesday, February 19th.

PROCEEDINGS OF THE LOWER CANADA BOARD.

We have much pleasure in informing the readers of this Journal that arrangements have been made by the Boards of Arts and Manufactures for Upper and Lower Canada, for the publication of the proceedings of the Lower Canada Board in these pages. It has long been the wish of the Board for Lower Canada to issue a journal of its own, but the expenses involved in the publication of a serial in the English and French languages, which would be necessary in Lower Canada, has hitherto deterred them from taking so responsible and expensive a step. The present arrangement will, we hope, be found conducive to the mutual advantages of both Boards, and at the close of the present volume it it may become a matter of consideration whether the issue of this journal should not be changed from monthly to bi-monthly, and a different title, more fully representing its official character be adopted. We trust that we recognize in this step taken by the Boards, an initiation to that unity of action which will be required in order to carry out the objects so ably and eloquently advocated by Mr. Principal Dawson in his opening lecture in Montreal, referred to in the foregoing paragraph, and which we would desire to see transferred at length to these pages.

Correspondence.

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—Amongst the educational wants of the Province is that of a system of schools in which our mechanics, apprentices and others may receive instruction in those branches of physical science which bear upon their respective departments of industry.

In every branch of art and manufacture some of the natural forces are brought into action; and the more perfectly the artificer is acquainted with the laws which govern those forces, the more directly can he bring them to bear upon his work; the more readily simplify his processes, and the more economically produce his results. Thus improvements are made in the industrial arts, misdirected labour prevented, and wealth increased. The wealth and progress of a community is in proportion to the well-directed industry of its individuals.

This is a consideration which should lead the Board of Arts and Manufactures to regard the importance of supplying the want I have mentioned. The establishment, by the Chief Superintendent of Schools, of a School of Art, will, as you say, relieve the Board of an expensive and difficult undertaking. This relief will give it more ample opportunity to attend to other departments of its duty, and I do not know of any that have more urgent claims than this. I am aware that the present means of the Board will not suffice for such a work; yet I think that a representation of its importance brought before the public, the municipalities and the legislature of the province, might procure such endowment as would enable the Board to establish in each of our large towns a free evening school, in connection with its Mechanics' Institute, for the study of physical science.

The failure of the many attempts which have been made to establish classes in Mechanics' Institutes for the study of this and other subjects, is, I think, attributable to the fact that they have been made upon a wrong principle. It is supposed that there ought to be in the expected pupils a sufficient desire for instruction to give them energy and perseverance to establish and sustain the class themselves: but I think the truth is, that although they may possess a taste for science, and be ready to respond to a well-directed effort to draw it out, yet no inducements exist sufficient to overcome the difficulties which belong to a course of private study. It is obviously the duty of some central recognized authority to establish schools, and by means of them to assist and cherish a taste for their objects. You are aware that in order to establish an efficient school of natural science a great preliminary effort must be made, requiring capabilities and resources far beyond the means of those who are to be instructed. A laboratory must be fitted up, apparatus procured, a teacher provided, &c. This must be done by some public agency which can afford to advance the means, and wait for the results. We cannot expect the full fruits of such an enterprise at once. At first but few may avail themselves of its benefits, and it may take a long time before its value is fully appreciated; but its ultimate effect upon the working classes of Canada cannot be doubted.

May not the expectation be entertained, that through the medium of the Board of Arts and Manufactures, a school for practical science may be established and conducted in such a manner as to bring the advantages it is capable of conferring within the reach of the working classes?

Your obedient Servant,

S.

Toronto, February 8, 1861.

Selected Articles.

ON SALT AND OTHER MINERAL CONSTITUENTS OF FOOD.

BY EDWIN LANKESTER, M. D., F. R. S.*

To-day, according to the announcement in the prospectus, I wish to bring before you what I have called the Mineral Constituents of our Food,—to which, generally speaking, we attach very little importance. Persons who prepare our food—cooks in the kitchen, ladies who superintend cooks and order dinners for large families, and people who consume food from day to day,—never think of asking whether food contains mineral constituents in the right proportions to secure health, and without which babies get rickets, young ladies get curved spines, fathers get gouty, and mothers get palpitations; and they do not think of ascribing these to the food which has deprived them of the proper mineral constituents. I think I can show you that the importance of this consideration can hardly be over-rated.

In order to illustrate the importance of these things, I must shew you the elementary constitution of human beings. Suppose we take a human being, put him in a retort, and apply heat to him; we shall find that, first, 111 lbs. of water will actually rise up from a body weighing 154 lbs.; and the next thing that comes off will be carbonic acid gas; then there will be ammonia; and then you might get a little sulphuretted hydrogen phosphuretted hydrogen, and gases of that sort; but you will at last get a quantity of ashes. Now, in the water you get the oxygen and the hydrogen. In the carbonic acid gas you get carbon and oxygen, and in the ammonia you get nitrogen and hydrogen. In the ashes which are left we get phosphate of lime, carbonate of lime, fluoride of calcium, chloride of sodium, sulphate of soda, carbonate of soda, phosphate of potash, sulphate of potash, peroxide of iron, phosphate of iron, phosphate of magnesia, and silica. These are the things of which I shall have to talk to you to-day, without which we cannot live. And if you will persist in having only refined sugar and the whitest flour, rejecting the brown; if you will persist in rejecting the salt and avoiding the liquor in which the meat is boiled, you may get albumen and fibrine, but none of these mineral substances; and then the first attack of fever or cold may prove fatal. Four men shall be

* Delivered at the South Kensington Museum.

travelling outside of an omnibus,—one may get acute inflammation of the lungs, another bronchitis, and the other two shall come off free. Was it the riding outside of the omnibus that did it? No; it was the state of their blood. They had lived somehow irregularly. So you may find half-a-dozen children all exposed to the contagion of scarlet fever; two take it, one dies, and the other four are free; but the two that have caught it, have lived in such a way that their blood has readily taken in the contagious disease; and the one that died has got in such a condition as to produce death. Hence the importance of attending to these subjects thoroughly,—not getting a little knowledge of them, but a knowledge of what is necessary to the feeding of men. If not, we shall somehow or other suffer.

Now, I shall just take up these constituents according to their importance, and, probably, according to your general knowledge of them. You cannot expect me to go into an exhaustive chemical analysis of this subject, and I may say we are not in a condition to do so. But I will go into it as well as I can in the time allotted. I have taken up the first substance—Salt. This is the only substance which we take directly from the Mineral Kingdom. All the other things we get through plants or animals; but Salt is a substance which we take direct from Nature to satisfy the demands of our system. Now, this salt is composed of two substances—chlorine, a gas, and sodium, a metal. These two substances combined together, constitute this salt, which you know determines the life and form of things in the ocean. Withdraw the salt from the ocean, and you will have none of the life which now exists there. Herrings, mackerel, cod-fish, and all the forms of fish that we get out of the sea would retire, and we should then have the fish of our rivers, such as roach, dace, and the other varieties. Thus you see how this salt influences life, and the form of life. We get it for our use from the sea, and from those deposits of salt which the sea has left. When obtained from the sea, the sea-water, containing from 400 to 500 grains of salt to the gallon, is evaporated. But the sea in former time has formed bays, and those bays have been gradually silted up, and the land has retired from the bay, and the bay now becomes a lake. This lake is a salt lake. We have many such salt lakes. The Dead Sea is a salt lake, removed a long way from the sea, like the salt beds in our new red sandstone in Cheshire.

Now, not only do the animals that live in the sea require salt, but man requires it also. We find that man bears a tax on his salt, and we find this the most convenient way of taxing India for the last century, and I believe that tax is still continued; and man must and will have his salt. Now the question comes as to how this salt acts upon the system. How do we know anything about its action? You see here is the quantity of it contained in a human body that weighs 154 lbs. It is not much, 3 ounces 376 grains; but you see it is a good deal if compared with the other things. When we take away the phosphate of lime and the carbonate of lime, we have only left about 10 ounces of the ashes, and of those 10 ounces the chloride of sodium, or salt, is 3⅝ ounces. Now the question is where this salt exists. If you take the muscles or the nerves of animals you do not find that they contain salt; but if you take the blood you will find it there. I do not wish to produce upon your minds any disagreeable reflection, but those of you who have tasted your own blood must recollect that it tastes of salt. We find three drachms of salt in a gallon of human blood; and that is the quantity in nearly all animals. Now you may ask, What good can it do? You may be sure that it does good. There are some people who are foolish enough to believe that man has been wrong in all ages, and that salt has done wrong. There was one gentleman who died because he thought salt was the forbidden fruit eaten in the Garden of Eden. He died a very few months ago, as I understand, quite a victim to his folly. Now if I were to take a vessel and divide it into two parts by a membrane such as is in our own body, and put salt and water on this side and spring water on the other side, when they were first put together they would be level, but in the course of time you would find that the spring water would go down and the salt and water would rise and flow over. Well, this is effected by a process which we call endosmosis, and which is greatly assisted by the presence of this chloride of sodium, or common salt. There is no other means of introducing chlorine into the system than through the medium of chloride of sodium, and we find that the chlorine becomes separated from the metal. We find in the gastric juices that there is a quantity of hydrochloric acid consisting of hydrogen and chlorine. Then, it seems to facilitate certain changes in the system which are beneficial to health, which are difficult to explain exactly, though I will just say that an experiment of this kind has been performed. Two sets of oxen have been taken by a great French chemist. He fed one set with, and one set without salt. For a short time there appeared no difference; but at the end of a month the cattle that had the salt were sleek and well-favoured, while the others were rough and in bad condition; and so it went on for two years, and, on the whole, there was no doubt that the healthier animals were those who had the salt.

If you take a very small quantity of hydrochloric acid and salt, and put it into water, and put the white of an egg into the water to which you have added the hydrochloric acid and salt, and then expose it to a temperature of 98°, it begins to dissolve; but if you put into water without salt it does not dissolve. So that you see there is this first action; in small quantities it assists digestion; so that you see the propriety of adding small quantities to our food. There are some persons who will not take it, but those persons are preserved by the cook putting it into puddings and cooked meats, and the baker putting it into the bread. Now, I need not, I think, dwell further on salt. I have notes here, showing how very early in past ages mankind directed attention to salt. We find that the Jews used it in their sacrifices. The Arabs put it on the table as a mark of hospitality; in Abyssinia he carries it in his pocket, takes out a lump and offers it to a friend to lick as a mark of respect and esteem. Then the Hindoos swear by their salt, and many of you may recollect that during the late war in Hindoostan, when the English officer wanted to bring the guilt home to the delinquent, he said, "Remember, Sir, you swore by your salt to defend the Queen of England," and so on. Then again, it was a mark of distinction in England in olden time: persons who sat above the salt were higher in dignity than those who sat below the salt. I will just say, finally, that although we may, by preventing its getting into food, take too little, yet there are provisions for getting rid of an excess.

The next thing is the phosphate of lime, which

forms the principal part of the earthly matter of the bones. Of this phosphate of lime, there are 5 pounds 13 ounces in a man weighing 154 pounds. Now this phosphate of lime must be a very important thing, or it would not occur in such large quantities. I draw your attention to it in the first place as constituting the earthy matter of the bone. If we suppose that there are 5 pounds 13 ounces in the system, at least 4½ pounds of that will be contained in the skeleton. I shall have occasion again to refer to the composition of bone; but bone contains about 40 per cent. of gelatine, 50 per cent. of phosphate of lime, 10 per cent. of chalk, and 1 per cent. of fluoride of calcium.

I should give here a very wrong idea of the importance of this phosphate of lime, and especially of the phosphoric acid which is contained in it, if I left you to suppose that the only important thing was its existence in relation to the lime in the bones; for the fact is, we find phosphoric acid in the blood, in the brain, and in the nerves, in a free condition. It is introduced into the system as phosphate of lime, or perhaps phosphate of soda, or phosphate of potash; but during the changes, we find phosphoric acid playing a very important part. Now that is an important thing to recollect, because we may be constantly taking a diet which excludes the necessary phosphate, or taking a diet in which it abounds. If we have it in too large a quantity, we are almost sure to kill ourselves: no sort of medicine that I know of will in any way correct this. Now how do we get those phosphates? I have shown you that this phosphate of lime is the most important, but other phosphates are found in the system,—phosphate of potash and phosphate of magnesia, for example. How do we get these? There are two sources of phosphates in our food. The first source is found in the cereal grasses, and the second in animal food. When I say cereal grasses, I mean all those grasses which belong to the grass order of plants eaten by man. Wheat is the most important; but barley, oats, rye, rice, maize, all contain phosphates. Animals, you know, eat grass of various kinds, and they thus get into their system these phosphates, and when we eat the blood, the nerves, and the muscles of animals, we eat phosphates. It is in wheat bread that we get the largest quantity, Now, a very interesting question has arisen out of our recent knowledge of these facts, and that is, "What is the best way of supplying those necessary phosphates to the human body?" and it has been found that the best way is from these grasses. But those grasses must have the phosphates before the animals themselves can have them, and it was pointed out by the great German chemist, Liebig, that one of the great drawbacks to the growth of wheat was the want of phosphates in the soil, and one of the great drawbacks in the development of animals and of man was the want of phosphate in the food which they eat. This has led to the discovery that we may apply phosphate of lime, not merely by the agency of animal and vegetable manure, but by the agency of what are called artificial manures. By means of these this phosphate of lime is supplied to the plant, and from the plant we receive it into the system, as we need it for the sustenance of our own bodies. There is one question which I will just mention here, which is of some practical importance. How do plants get a supply of phosphate of lime? That explanation will give you an idea how it is that certain substances act upon our own systems in conveying certain phosphates to our blood. I told you in my last Lecture that carbonate of lime was soluble in water containing carbonic acid gas: so is phosphate of lime, and, when the water comes down to the earth which contains this phosphate, it actually dissolves it, and then the little plant can take up the water and the phosphorus, and apply it to its own use. So in the same way, if we take it into our stomach, and add to our food carbonic acid gas, we assist the solution of those phosphates. Thus it is that we prefer liquids which contain carbonic acid gas in them, and the taking carbonic acid gas is found by experience to be beneficial. Thus we take bottled beer, which contains a considerable quantity of carbonic acid gas; we take champagne, which owes its sparkling properties to the carbonic acid gas.

Now, I must leave the phosphate of lime, important as it is, and call your attention to a third group, the salts of Potash. Just as we find sodium in plants that grow in the sea, we find potash in plants that grow away from the sea. Those plants contain large quantities of potash, and hence the name potash, from the fact that wood which is used for boiling the pot contains this in its ashes, and, hence those ashes are called "pot-ashes." Now, there are some plants which are called potash plants, and I do not know a more important practical point than that certain plants contain potash, and that the exclusion of these from diet is a very bad thing. Potatoes contain potash; now I do not know whether any of you have speculated upon the reason why Europe should have seized with such tenacity upon that plant which is foreign to its shores; but there are philosophical writers who trace the cessation of plague and other epidemical visitations to the use of the potato. When we come to examine the potatoe we find it contains not so much starch as rice, and very little nutritive matter. It seems that, at the first glance it was a matter of very little importance whether we ate potatoes or not as long as we got flesh-forming substances; but here are these ashes in the proportion of 1 per cent., and what are they principally?—Potash. The quantity of ashes in a pound of potatoes is not much; but that quantity seems to be explanatory of the great fact that the health of Europe has improved since the potatoe has been eaten. Other vegetable foods—asparagus, radish, turnips, carrots, parsnips,—are "potash plants," and all those who exclude these things from their diet do wrong; they also do wrong who throw away the water in which they are boiled. It is better to make vegetable soups of the water and let children be encouraged to take them. Watercresses may be eaten by them, and lettuce, chicory and endive, and a variety of salads when they can be got fresh; and, when they have been dried, these things may be used in the form of soups, with carrots, turnips, and such like. I was lecturing on this subject a little while ago, and my friend Dr. Noad informed me that he had made an analysis and found that water, after boiling one pound of potatoes, contained 17 grains of carbonate of potash, and the sulphate which he obtained from cabbages was 21 grains, and he found the same with regard to carrots; and if he had gone through the whole range he would have found, I have no doubt, salts of potash in all of them. I would not advise you to substitute carbonate of potash from the doctor's shop for the potatoes, cabbages, water-cresses, and those things, although I believe, medicinally, that that substance sometimes saves a man's life.

If you feed men on chloride of sodium, and do not give them salts of potash, you will give them a disease which more than decimated our navies up to the year 1780,—scurvy. That disease broke out in the utmost intensity during the potato famine, and although the people were supplied with rice and other things, the disease went on; thus showing that the potash alone could arrest certain changes that went on without it.

In the year 1780 Sir Gilbert Blane discovered that lemon-juice would cure scurvy, and now, since that time, if a ship goes out for six weeks without lemon-juice or lime-juice, a fine of 5*l.* a day is incurred. The worst part of it is that ships are sometimes supplied with something which is not lime-juice at all, but sulphuric acid and water. It is not the acidity that is wanted, but it is a citrate of potash that is required.

There are one or two other considerations that are very interesting. Thus if you take potash with citric acid, the citric acid is destroyed and the potash remains in the tissue. Destroyed, how?" I shall show you, when we come to the next Lecture, that starch and sugar are not unlike citric acid, and the way in which they act is to supply animal heat.

I come now to the carbonate of lime. Well, that is an important thing. Not so important, perhaps, as the other two, but when I tell you we have got 1 lb. of it in 154 lbs. you will see that there is quite a sufficient quantity of it to make it of importance, and I could not say that phosphate of lime would make up for carbonate of lime. We get it from the water we drink. I showed you in our last Lecture that nearly all the water we got from wells contained carbonate of lime; but there are a number of plants which contain considerable quantities of carbonate of lime. Beans and peas contain it, and also clovers and vetches, and plants of that sort, which only grow on chalk soils. When we take it in the form of the water which we drink, then we take it dissolved in carbonic acid, which I referred to just now.

There are some other substances to which I have not yet referred: Peroxide of iron is one. It exists in very small quantities—in not more than 150 grains in the human body. Now that substance is contained in the blood, and that small quantity seems to be necessary to the health of our body. We meet with persons with pale faces indicative of the want of iron; we administer iron, and they recover their good looks and their roses, and all arising from the iron getting into their blood. The French are sometimes in the habit of performing the process of incremation on their dead friends—that is to say, they burn them instead of burying them,—which is a much more wholesome process. The Romans burnt their friends, and collected their ashes in an urn; but the Frenchmen,—and they would not be Frenchmen unless they could improve upon the old Roman plan,—after burning their friends, take their ashes, and extract the iron from them, and convert it into a ring to wear in memory of their dead friends.

I have nothing further to say with regard to the iron, than that it may be supplied medicinally.

Now, then, there are some other substances which are perhaps not so material. Here is Silica, which you see exists in the small quantity of three grains in the human body—it is distributed in the nails, but more especially it is found in the enamel of the teeth. Teeth have a coating of enamel, which is formed of a certain quantity of silica, so that you see it seems to be necessary to the comfort and welfare of a man. Again, we find that Magnesia exists commonly in the soil of Scotland. It is taken up by the oat-plant, and conveyed to the blood of Scotchmen, and Scotchmen have been found to contain magnesia in their blood.

If you do not get enough iron, then almost any of these metals will supply its place. Even mercury will supply its place for a time, and every man is the better for taking a blue pill now and then. Copper has also been found in human blood, but that is accidental; but it appears that we are in the habit of eating pickles, and bought pickles frequently contain copper, which is added to them to make them green and inviting to the eye. Throughout Europe there is a quantity of these coppered pickles consumed.

Then there is this beautiful substance Iodine, which exists in a solid body at the ordinary atmospheric temperature, but is vaporised at a higher temperature; and this exists in the sea-water, with chloride of sodium and bromine; and thus it appears that it occasionally enters into the human system, and it is found in small quantities in the human breath—and there has been a dispute whether it exists in the human body. Now, this iodine has been found in the bodies of Frenchmen, but not in the bodies of Genoese; and this accounts for the fact that the Genoese have *goitre.* This bronchocele, or swelling of the glands of the neck, is called *goitre;* and this is the substance which, in the Frenchman, prevents him getting *goitre,* when he is among the Genoese, who are suffering extensively from this complaint. This disease is common among the Swiss mountains, and the Pyrenees. There are individuals in our country who are constantly suffering from the enlargement of the neck, and we know that the iodine is a remedy. It has also been found in watercresses, especially those watercresses which grow near the sea. I have recently examined some watercresses in London that had none.

I have shown you that in cooking you are very likely to get rid of these mineral constitutents. In cooking care must be taken against throwing away the water. The substitute is salads, or raw fruit, and thus we take oranges, of which children can hardly take too many. Then, soups and stews, in which the salt has not been thrown away, are good. —as also are preserves, whether in oil or sugar. You preserve their mineral constitutents; and if you apply these practical hints, you will be better in health.

ON THE ANTIQUITY OF THE HUMAN RACE.

BY PROFESSOR D. T. ANSTED, M.A., F.R.S.

I suppose if there is one department of Geology mor particularly interesting than any other, it is that which relates to the border-land between the present and the past—the passage from that which is to that which was; the connection, if such exists, of the races of today with those of yesterday, and the means available for tracing the resemblances and the differences between what has been called the Ancient World, and our own modern and personal experience.

The human race was at one period, and that no distant one, regarded as coeval with the first introduction of life on a very recently-created world. Step by step the careful and unprejudiced observers of the great truths of nature have become convinced that man not only was not coeval, or nearly coeval, with life on the earth, but that the world is of extremely ancient date—

that numerous tribes of animals and vegetables had preceded man by long intervals—many large groups and entire races having succeeded each other, the earlier ones dying out very long before he appeared. If anything can be said to be known in geology, or proved by incontestible evidence, it is that our forefathers, whenever they came upon the stage, and however they were first introduced, formed an addition to groups of animals which then peopled the various lands. They entered on an inheritance prepared for them, and have since continued to cultivate and rule over it. It becomes a question to be determined by natural history evidence, in which part of the great series of organised beings did they first appear?—who were their early associates?—what geological events have occurred since their introduction?—and at what point in the general geological sequence are we to write:—Here are the first indications of the existence of intelligent beings; at this stage of animal life the human intellect first dawned?

I trust it is altogether needless that I should apologize for introducing to you in this place a question of science so legitimate. The question is one in which the evidence must be calmly and carefully weighed, and the conclusion accepted to which the balance of evidence points. On the one side there is a written document of the highest authority for the purposes and in the matters it was intended to teach; but notoriously, and by almost universal consent, not binding upon us in respect to matters of experimental science and observation, these requiring only the fair and honest exercise of human reason for their elucidation. On the other side is the great volume of Nature, written by a sure hand, engraved in tablets of stone, which, if broken, are not defaced, and which are capable of interpretation, if we will only exercise patience and care. These two sources of truth cannot really be at issue, although we may be unable to see how they agree. We must not close our eyes to the truth, from whichever source it is obtained; and in the question we now enter upon—the Antiquity of the Human Race—whatever facts can be discovered bearing on the subject, must be accepted, and we are bound also to accept the fair inferences to be drawn from them.

Assuming, then, that the evidence of human antiquity is to be derived chiefly from the discovery of human remains in various deposits, and this being almost the only means open to us when we endeavour to extend our researches beyond written history, we are bound to accept it as given by Nature, examining it carefully, and getting the results as we best can, admitting that we must look to geology to determine this great archæological problem. Now, it seems to me that the points to be made out in this matter of the antiquity of the human race, are of this kind:—We must first obtain a starting point—some object buried beneath deposits, or associated with other contemporaneous things elsewhere so buried; we must make sure that time was required for forming such deposits as overlie it, and, indeed, that the deposits we find over it are of such a nature as to require a considerable lapse of time in order to produce them. The way in which the evidence will then come out I will explain to you. But first, the mere fact of finding deposits overlying the discovered object and each other, will not alone amount to much; we must show that they were formed in such a way as to require time. Take, for instance, a broken flint. One side of such a flint may have been recently broken, and the other side worn in a manner which must be a result of exposure for a very long time to the action of the weather. When, therefore, we find a specimen with appearances of this exposure, we are at liberty to assume that time was required in order to produce it.

We have also to prove that any remains that we may find in rocks of this age really were produced by human agency. We must carefully examine the evidence on that head.

We must next prove that they were really found in those beds that we have already proved by independent evidence to be of very great antiquity.

We must also satisfy ourselves that, if found as supposed, the objects in question were not placed there for the purpose of our finding them, or by any accident, whose result would be to make us imagine that what was really produced at one time belongs to another. Before the Romans conquered Britain there certainly were people who lived in these islands in an extremely rough and savage state, sometimes even in houses dug out of the earth. These people may have dug pits and lived in those pits; and it is possible to imagine that specimens we now obtain from what seem to be gravel-beds, were really dug out of such habitations. We must satisfy ourselves, therefore, that the broken flints were deposited contemporaneously with the bed in which they occur, and were not subsequently inserted.

Now, in order to obtain the starting-point that we require, we must limit ourselves to geological events of a very recent date. The more recent of the various deposits accumulated during a long succession of ages at the bottom of seas which once covered what is now Western Europe, were either themselves small or in patches, or have since been extensively removed by the action of water. Among them are mixed heaps of fine sand, and large angular or rounded blocks of stone, resting indifferently on, all the underlying rocks. These so-called blocks, or boulders, include a variety of fragments of rock, some removed for hundreds of miles, and others only from the near neighbourhood. With them are stones of various sizes, often placed among the sands in such a way as to render it impossible that all can have been beaten and rolled together for a long time in water. The stones are not unfrequently furrowed and scratched, and the rocks beneath, if hard, are similarly marked. This is the deposit called by geologists *boulder clay*, and believed by them to have been produced at a time when large icebergs floated or drifted over the land where such materials are now deposited. These are, therefore, remains of an icy or glacial period, or periods, during which most of the present land of Western Europe was under water; when icebergs came down from the Arctic Circle to our latitudes; and when the land that did exist was for the most part in a different position from that which now exists. These beds are the old glacial drift of Northern Europe. They belong to a climate probably much warmer than any we now have north of the Mediterranean (except, perhaps, that of the South of Spain); and, during this earlier period, the land of Southern Europe was peopled by animals resembling those now inhabiting Northern Africa, and ranging through the whole of that great continent. The shells of the adjacent seas were also those of the warmer parts of the Mediterranean. Most of the quadrupeds, and many of the shells before the the time of the boulder clay, or old glacial period, are different from those of the more recent period. I propose, for the sake of convenience, to take this old glacial drift, or boulder clay, as the starting-point for my present purpose. In itself it generally contains few fossils. A great deal of the material lying over it, or at least deposited more recently, is what is called gravel or drift, and includes the objects of the present inquiry. Some of this is ancient, some more modern; some is of fresh-water origin, and some has certainly been formed in the sea. Some beds contain delicate shells, and have been deposited in calm water; some appear as if they had fallen down in a turbulent ocean. Whenever ocurring, gravel is a deposit amongst the newest of those

talked of by geologists. It is hardly even admitted to rank among the newer of the three great groups of deposits called *Tertiary*. It belongs to what Continental geologists call *Quaternary Rocks*. It is widely dispersed, but rarely in large deposits.

It is important for my purpose that you should recognize the antiquity of the boulder clay or old glacial drift, our starting-point. Relatively, or compared with underlying deposits, it is modern; compared with it even the beds of crag beneath it are exceedingly ancient. The chalk below the crag belongs altogether to another world, and yet the chalk is but a thing of yesterday compared with large series of stratified rocks common throughout Europe. The London clay, which is very much more modern than the chalk, belongs to a time when there scarcely existed a species of animal, and very few plants, identical with those now inhabiting our country. In the yet older rocks—those below the chalk —we lose nearly all record of existing creation. Under the boulder clay, then, there is a long series of deposits, of which the most recent is of much earlier date, and during which the climate was exceedingly warm in this part of the world. After that there appears to have been a series of considerable elevations in Northern Europe, producing a great amount of cold over almost all the land then above the water. This was followed by a remarkable period of northern depression, during which icebergs disappeared, and the climate became again warm. Afterwards there was another elevation in the north, and another period of glacial drift took place; and finally, there were depressions of very considerable extent, allowing the upper beds of the drift to be deposited.

These facts are proved in various ways, and I shall explain to you presently in what way the evidence is obtained. At any rate, I must suppose you to admit that the boulder-clay period is of great antiquity, and preceded the last great changes of climate, during which many of the animals appear to have changed. There was a time when elephants, hippopotamuses, and other animals now belonging to warm latitudes, ranged so far north as actually to have been caught by the ice in the Arctic Circle. There are instances where even the flesh and the contents of the stomach have been preserved. When these animals ranged over the whole of the land in Northern Europe, the temperature must have been exceedingly different to what it is now; for at present there is no food within many hundreds of miles of their ancient haunts, whilst of the animals themselves the woolly hair covering a thick hide was evidently adapted to cold climates, and marks the climatal condition of the period which preceded the boulder-clay. Assuming, then, that the boulder formation itself is of great antiquity, we must now consider the state of the different beds that lie over it. It is here that we find those curious remains which are believed to have been formed by human agency, and we must therefore understand clearly what were the beds thus characterised. [The Lecturer then directed attention to a section representing the condition of the country between Norwich and the sea.] Along the coast of Norfolk, and in the interior of the country for some distance, the boulder clay is met with on and near the shore, but seen only occasionally, and at low water in a submerged forest, the remains of a considerable quantity of tree vegetation, which has been entirely buried long enough to allow all the other deposits to accumulate over it. The boulder clay lies over it, and over this clay is the upper drift. The history of the submerged forest is curious, because the state of things to which it points exactly corresponds, as far as can be made out, with what is known in other parts of Europe, where also there is evidence of a much warmer period having preceded the boulder-clay period than characterised that period itself. The deposits overlying the clay here and elsewhere may be considered to form three distinct groups. There is, first, the group of cavern deposits, then the raised beach deposits, and then tho group of superficial gravels and sands, and I must say a word or two with regard to each of them.

By caverns I understand natural open spaces in rocks occurring in various parts of the earth, often partially filled by deposits of various kinds drifted into them. When such an opening has been exposed to the action of a river or the tidal action of the sea, or is open above so that animals can get into it, there will be drift carried in and deposited, while, at the same time, remains of animals will accumulate in it, and there will be a mixed series of deposits. Should the rock in which the cavern occurs be a limestone, the water that trickles in from the crevices will be loaded with carbonate of lime. On dropping down on the floor of the cave, such water will evaporate and carbonate of lime will be left to form what are called *stalagmites*. The appearance and peculiar conditions of such caverns will be illustrated by the two or three diagrams I have here. [The Lecturer then referred to a series of drawings of well-known and interesting caverns chiefly in Sommersetshire and South Wales. He afterwards referred to another diagram representing a cavern in Sicily, near Palermo, recently described by Dr. Falconer. He then proceeded to describe their contents as follows]:—

In the cavern at San Ciro, near Palermo, there is an enormous deposit of bones. Twenty tons' weight of the bones of the hippopotamus have actually been taken from it within a very recent time for the sake of burning into animal charcoal. Now, it is quite clear that there can have been no accumulation of bones of this kind by human agency. All the hippopotamuses ever brought into Italy by the Romans, if accumulated together, could hardly have sufficed to fill this one cave; and, not far off, bones of 300 individual hippopotamus have been found in another cave. It is quite clear that the cavern existed for a long period as the habitation and burying-place of the large quadruped whose bones are so abundant. In our own country the caverns have been used for similar purposes. In the limestone rocks in Yorkshire, Devonshire, and elsewhere, there is good proof that they served as dens; for we find in them the remains of bears and hyænas in enormous numbers, and occasionally remains of elephants, rhinoceroses, and hippopotamuses. To illustrate the appearance and condition of the cavern-bones, I have drawn upon the resources of your own museum. Among the specimens before you are teeth and bones of the ordinary inhabitants of caverns. Generally speaking, each cave seems to have been inhabited by one group of animals, and as the caverns have generally been partly excavated by water and partly filled up by aqueous drift, so, in some instances, they have been entirely filled up, and almost obliterated. The Sicilian cave of Maccagnone is a remarkable proof of the accumulation of these bones. There is a bony breccia on the bottom of the cavern, and on the roof of the cavern is another mass, which is really a part of the same breccia as that found on the floor. The whole of this cavern must at one time have been filled with this breccia, which has since been partially carried away by the sea. Now, it is a remarkable fact that human remains have been found mixed up with the fragments of bones at the top of the cave. It seems impossible that they could have got there except as part of the original deposit.

We come next to the raised beaches, of which a large number are known to range round our own coast. An old beach is seen [pointing to a diagram] some feet above the level of high-water; above that there is a deposit of limestone. In this case there is an elevation of only three feet; but in some parts of the coast of

Wales the old beach is 1,300 feet abeve the present sea level, and yet it is quite impossible that the accumulation of rolled pebbles and shells so far above the sea can have been deposited in any other way than by slow accumulation at the sea level, at a time when the sea was limited by an ancient coast and cliff, now a mountain side. The whole has since undergone elevation, which has brought the beds up to their present level. As a matter of fact all the way round our own coast, on various parts of the coast of Scandinavia, along the western parts of Europe, and in the Mediterranean, there are unmistakeable evidences of change of level going on, although it is difficult to understand how such changes could have gone on without producing great breaks. There is, however, no break in the succession of life; the animals that belong to one part of the period are traced through all the series of deposits, or else have died out gradually as we get nearer to the new deposits. The raised beaches generally contain shells which we would find at the present day on the actual beach adjacent. There is no possibility of these shells having been carried there by man, for they often cover several square miles of surface, and occupy exactly such level portions eaten by the sea waves out of a cliff which could be easily covered before the elevation. The cliff often presents a succession of steps, produced by the alternate elevation and repose during the time I have alluded to. Raised beaches, therefore, mark great changes during a long time, and the sands, gravels and marls indicate the time during which such changes were going on. Since, however, we can trace the history of cliffs for hundreds of years, and find the change very small, it becomes difficult to imagine that the same causes can have acted for a sufficient period to effect the amount of change we see. The remains of animals belonging to the period in question are some of them such as are now only to be found in Africa. We know, indeed, that such animals can live in much more extreme latitudes, and we have a remarkable proof of this in the discovery of the complete carcase of an elephant in the Arctic Seas, provided with a warm coating of hair, showing the adaption of those animals to a climate perhaps not at all warmer than we have now. However the case may be with regard to climate, we have the remains of the elephant, the rhinoceros, the bear, and the hippopotamus, lions, tigers, and hyænas, and also other animals now altogether extinct, remains of several large kinds of cattle, antelope and deer, one approaching to the reindeer, and others diverging from that type, but all belonging evidently to climates admitting a considerable amount of vegetation, but not necessarily warm.

We come next to the other contents of the caves. Associated with and among the bones of these animals that are almost all extinct, so far as this country is concerned, are found such specimens as are on the table before you. These three, for example [the Professor pointed to some trays before him], contain a number of specimens of flints found among the bones in these localities. When you examine these, I think it will be impossible for you to come to any other conclusion than that they were formed by human agency. Some of the specimens, taking them alone, would be sufficient to show that they were constructed by a number of blows probably of another flint, each blow chipping away a small portion. It is possible, though barely so, that one such specimen should have been formed accidentally; but, if you observe them, you will find all are chipped away in the same manner, and by a peculiar method. They have been formed by blows, one striking on the right, and the other on the left; they all have very definite shapes, being rounded at one and pointed at the other; and, generally spreading, they have a depression on the under part. If, as is the case, we find such specimens, not only here and there, but in masses of fifty or a hundred together in one locality, the accumulated evidence evidently derived from their artificial character is quite sufficient to show that they were formed by some intelligent being. We know that no animals are formed in a way as to be able to construct these flints, and we are therefore bound to consider that they were formed by human agency. It is not necessary to detain you with any account of the peculiarities of these things, but it may be interesting just to allude to the way in which flints used to be manufactured for muskets; and these will show you how precisely the same effect is produced by artificial means. I have also here a specimen of one of the weapons used by the natives of Port Essington, in Australia, which is of a similar character. Another specimen [showing one] was broken off by a gun-flint maker; and looking carefully at it, you may recognise the artificial character of the fractures. Next let us take up a number of the flints recently found in gravel and caverns. I think you will not be inclined to doubt, when you see them, that they must have beeu the weapons and instruments used be men; and no one, I believe, can honestly arrive at any other conclusion. Seeing their evidently artificial character, we are bound to assume that they are human productions, and that is a point which I shall take for granted.

We must now consider what proof there is that they were really found accumulated in the gravels belonging to a period very different from our own. You may say they were perhaps made by the Druids or the Celts, or the inhabitants of England immediately preceding the Danes, Saxons, or Romans. Now, it is a singular fact, that there was found, and carefully described and figured in a well-known antiquarian work, in the year 1797, an implement so exactly like those I am showing to you, that if you had it before you would not be able to distinguish one from the others; and since then several others have been found in the same locality. This deposit is in Suffolk, and the bed containing the flints is covered with sands and marls and red brick-earth. About twenty years after this discovery, a gentleman living at Amiens had a sort of instinct that there existed human remains in the gravel in his country, and he made up his mind to find them, and did find them. The three diagrams to which I now direct attention show the condition under which the remains were found, and several of the specimens themselves are before you. Where these were found the underlying rock is chalk; above the chalk is a series of beds of various kinds; and in the lowest of these beds about 100 feet above the present valley of the Somme, are found the objects in question. A gravel similar to that in which they occur is accumulated in various patches all over the country. It is not necessary to mention the different places where they occur. It is enough to know that there are at least half-a-dozen places in the same neighbourhood, where patches of gravel have been found containing similar worked flints. These beds contain also remains of Elephants, hippopotamuses, and rhinoceroses, in some abundance. There appear, in some cases, to have been pieces of wood immediately associated with the specimens themselves, presumed to have been the handles buried with them, and decayed. Pieces of bone found in the neighbourhood are supposed to show, in some cases, actual marks of weapons; and it is said that they could not have been broken accidentally in the way in which they are found, as they are bruised and broken with a dent, as if by stone knives or similar instruments. Above the beds containing the flint remains are several newer deposits, some of the uppermost of which contain other human remains, not of the same kind, though certainly belonging to a very ancient race. In the lower beds the weapons are roughly hewn, with other stones;

but in the newer they are less roughly manufactured, and sometimes perfectly smooth and polished. In the upper beds of all there are remains of the Romans; while in the bottom deposit the human weapons are mixed with the remains of extinct animals totally different from those which now inhabit the country. Between the two are beds of sand, brick-clay, and earth, containing remains of animals much nearer the present time. Above that are the deposits containing remains of the Romans, and above that, vegetable soil.

(*To be continued.*)

NEW INDUSTRIAL PROCESSES.

Patera's Process for Extracting Silver from its ores.

By Clement Le Neve Foster.

The process in question was originally suggested by Dr. Percy, F.R.S., of the Government School of Mines, and has of late years been taken up and carried on, on a large scale, by one of the most celebrated metallurgical chemists in Austria, viz., Herr von Patera. This process is of special interest, on account of the analogy it presents with the well-known "fixing" in photography, which is nothing more than dissolving out the chloride of silver (which has not been acted on by light) by means of hyposulphite of soda.

In the metallurgical process this property is made use of in the following manner:—The ores which contain the silver in combination with sulphur, or with sulphur and arsenic, are roasted with green vitrol and common salt, and thus is produced a chloride of silver which may be dissolved out by a solution of hyposulphite. The silver can then be precipitated by sulphide of sodium, falling down as sulphide of silver. All that is necessary to be done then is to heat the sulphide in a muffle in contact with the atmosphere; the sulphur escapes in the form of sulphurous acid, and the silver remains in the metallic state. It is then melted in plumbago pots and cast into ingots for the mint. Such is a rough outline of the process which is now, and has been for some years, in operation at Joachimsthal, on the the northern frontier of Bohemia. The ores which are subject to this process are rich in silver, containing on an average two per cent., but often as much as 10 per cent. Ores containing less than one per cent. are melted down with pyrites in a cupola blast furnace for regulus or *matte*, which is then treated as the ore.

The advantage of this process are manifold, 1stly, Ores containing large amounts of arsenic can be thus successfully treated, when Ziervogel's process would fail. 2ndly. the expense of heating a strong solution of salt, as in Augustin's process, is got rid of, as the hypo-sulphite is used cold. 3rdly. The hypo-sulphite filters quicker and better than the brine in Augustin's process, for the dissolving power of hyposulphite being great, a weak solution may be used. 4thly. The solution of hyposulphite may be used over and over again, for it is being continually renewed, as this is one of the peculiar points in the process, it deserves particular attention. The precipitation of the silver is effected, as has been before stated, by sulphide of sodium, and this is a polysulphide, for it is prepared by calcining soda with sulphur and then boiling it with sulphur. In this manner a polysulphide of sodium is formed, but in contact with the air some hyposulphite of soda is generated, and thus, each time that the silver is precipitated, some hyposulphite of soda is added to the solution. In this way Herr von Patera, who commenced with 14lbs. of hyposulphite of soda (and who yearly extracts more than 3,000lbs of silver), has never needed a fresh supply, and has, in fact, been obliged to throw away quantities of solution, as his stock was always increasing. The expense of this process is not great; the extraction of a pound of silver from the ore costs, on an average, only 9s. 9d., whilst by the method of smelting formerly in use, the cost of production of a similar quantity of metal was no less than 16s. —*Journal of the Society of Arts.*

Preparation and Uses of Neutral Sulphite of Lime.

Anthon, a manufacturing chemist, of Prague (*Oesterr. Gewerbeblatt.* 1860. No. 1), makes sulphite of lime by passing gaseous sulphurous acid over hydrate of lime spread upon hurdles to the depth of one or two inches, and arranged in a close chamber; or he places the hydrate of lime in a barrel, which is made to revolve, and passes the sulphurous acid into it. The absorption of acid by the lime takes place quicker when the latter plan is adopted. It is only necessary to wash the sulphourus acid when it is contaminated by sulphuric or some other strong acid. When the lime is kept well in motion, the saturation is completed in from four to eight hours, and is recognised by the white colour of the hydrate changing to a pale yellow.

The principal use of sulphite of lime, which the author points out, is the ready preparation of a pure sulphurous acid.

New Fusible Alloy.

Mr. Wood has found that cadmium is preferable in many respects to bismuth in rendering a mixture of metals easily fusible. He prepares an alloy fusing at +76° centigrade by melting together 1 or 2 parts of cadmium with 2 parts of tin, 4 parts of lead, and 7 or 8 of bismuth.

Clarifying Coal Oils.

Messrs. Dumoulin and Coutelle have been making a series of experiments with a view of rendering heavy oils suitable for ordinary lighting purposes, and have succeeded in producing a magnificent light, free from smoke and smell, and adapted in all respects for burning in a room. The following is their process:—In a close vessel are placed 100 lbs. of crude coal oil, 25 quarts of water, 1lb. of chloride of lime, 1lb. soda, and ½ a pound of oxide of manganese. The mixture is violently agitated, and allowed to rest for 24 hours, when the clear oil is decanted and distilled. The 1000lbs. of coal oil are to mixed wilh 25lbs. of resin oil; this is one of the principal points in the manipulation, it removes the gummy parts from the oil and renders them inodorous. The distillation spoken of may terminate the process, or the oils may be distilled before they are defacated and precipitated.—*Le Genie Industriel.*

A New Use for Paraffine.

Every chemist has experienced the annoyance of finding the stopper of his liquor potassæ bottle hard set. Greasing the stopper would only afford a partial remedy, and moreover, would be objectionable chemically, inasmuch as the liquor potassæ would suffer contamination. Paraffine is unobjectionable; not only does it not dissolve in alkaline leys, but its lubricating properties are sufficient to prevent all jamming of the stopper.

Perchloride of Iron as a Deodorizer.

From the experiments of Dr. Hoffman and Professor Frankland, it appears that perchloride of iron far surpasses both "chloride of lime" and lime, for deodorizing sewage water.

NOTICES OF BOOKS.

A Practical Treatise on Coal, Petroleum, and other distilled Oils, by ABRAHAM GESNER, M.D., F.G.S. New York: Balliere Brothers, 440, Broadway.

This work will, no doubt, be eagerly sought for by many interested in Petroleum, who would be led by its title to suppose that it entered thoroughly into the discussion of the purifications of the natural oils as well as the coal oils. This is not the case, and the book on the whole is disappointing, although it ought to find a place on the shelves of our Mechanics' Institute Libraries. But while it does not satisfy the requirements of the present day, it will be found very useful in directing the practical manipulator to discover for himself the best method of purifying the natural oils (of which there are many varieties) he may chance to work.

The Manufacture of Vinegar; its Theory and Practice, with especial reference to the Quick Process. By CHAS. M. WETHERILL, Ph.D., M.D. Philadelphia: Lindsay & Blakiston, 1860.

A very useful work for vinegar manufacturers. The theoretical part is divided into four chapters, which treat respectively of the Chemical Principles involved in the Manufacture of Vinegar—Sugar—Alcohol and Acetic Acid. The practical part describes, in five chapters, the General Details of the Processes Employed—The Slow Process—The Quick Process—Examples of the Practice of the best European Factories—Conclusion.

MISCELLANEOUS.

Importance of Ventilation.

Passing from the private shop to public institutlons we are compelled to admit the same radical fault—the want of that element which is "the breath of life." In our churches, schools, and assemblies, people who go there suffer more or less from this evil. It is proverbial how persons, young and old, suffer from colds, bronchitis, and influenza; all of which are said to be "caught" when they return from some public place of assembly. The question naturally arises, How is this? The answer is that it is caused by the sudden change which the body undergoes in passing from a heated impure air to that of the natural temperature, containing also its proper proportion of elements. Man requires for his health one gallon of air every minute of his life; the individuals of a church congregation are rarely, if ever, supplied with that quantity. Only at the cathedrals is the air space in proportion to the worshippers. A man of large lungs inhales about twenty-five cubic inches of air at each respiration; he breathes 11 times a minute, and thus requires nine and a-half cubic feet of air every hour. Now, when there are a thousand persons under one roof (some of the metropolitan churches and chapels containing 2500 persons) for a couple of hours, it is evident that twenty thousand cubic feet of air are required to supply that which is necessary for existence to these thousand persons in a pure atmosphere, so that of course a much larger quantity than that is required in order that a current can be established to remove the effete matter of exhalation. The evils of vitiated air are also more to be guarded against, because persons can live in it without being aware of its danger, as far as their sensations are concerned. When we enter a crowded assembly on a cold day the air is always at first repulsive and oppressive; but these sensations gradually disappear, and we then breathe freely, and are unconscious of the quality of the air. Science, however, reveals the fact that the system sinks in action to meet the conditions of the impure air, but it does so at the expense of having the vital functions gradually depressed, and when this is continued disease follows. No disease can be thoroughly cured when there is a want of ventilation. It is related that illness continued in a family until a pane of glass was accidentally broken, and then it ceased; the window not being repaired, a plentiful supply of fresh air was admitted. The practice of building sepulchral vaults under the churches was fraught with the greatest evil to the health of those who went into the edifice for sacred purposes. But with few exceptions it is now interdicted by the Legislature; still a great deal in the way of improvement has to be done. Nearly all the churches in the empire require some artificial means of ventilation to render them physically fit receptacles for the body during a prolonged service. The Sunday-schools also, as a general rule, are very ill ventilated; and lessons in the second hour are far worse rendered than in the first, solely arising from a semi-lethargic coma that comes over the pupils breathing a carbonic air which has already done duty and been inhaled by others several times. However it is to be regretted, it is yet true, that people will, sometimes, sleep during the sermon. Now, the minister must not be twitted with this, for with the oratory of a Jeremy Taylor or a Tillotson people could not be kept awake in an atmosphere charged with carbonic gas, the emanations of a thousand listeners. The churchwardens should ventilate the churches, and see that the congregations have sufficient air for breathing; if people go to sleep, they are more to blame than the preacher.—*Piesse's Laboratory of Chemical Wonders.*

Coloured Liquids.

The gradual decoloration of coloured alcohol by the influence of light and the precipitation consequent on on the chemical change produced, is of importance to the druggist anxious for the showy appearance of his windows. The following remarks will therefore be read with interest and benefit:—Solutions of various salts or metals in hydrochloric acid are, some of them, of very great intensity and beauty. Thus, a yellow liquid is obtained by dissolving 3 parts of perchloride of iron, or hydrated peroxide in 100 of hydrochloric acid: the colour may be heightened by adding some hydrated oxide. Various colours are produced with the solution of carbonate of cobalt in hydrochloric acid. The salt of cobalt used must be pure, especially free from iron or nickel, which would prevent the formation of the blue and red shade. The green cobalt colour is obtained by dissolving 3 parts of the protocarbonate in 100 parts of the acid, and filtering. By the addition of a few drops of the above yellow liquid the colour is deepened, and loses the bluish tinge. A blue colour is prepared by dissolving six parts of the protocarbonate of cobalt in 100 parts of the acid, and boiling for about two minutes to remove the carbonic acid or chlorine held in solution. Neither of the above two colours should be diluted with water, as this would change them to red. The violet colour is obtained by dissolving 34 parts of the protocarbonate of cobalt in 100 parts of the acid, mixed with 5 of water, and boiling before filtering. A very fine red liquid is obtained by dissolving 45 parts of the protocarbonate of cobalt in 100 parts of the acid, diluting with 45 parts of water, and boiling. All the cobalt colours change by heating the solutions, which gives them more or less a blue tinge; but, on cooling, this gives way to the colour intended. The solution of carbonate of chromium in hydrochloric acid evaporated until it becomes solid on cooling, and dissolved in alcohol in the proportion of 25 parts of the salt and 100 of the spirit (to which are added 5 parts of acid,) furnishes a fine deep green. Four parts of crystalized acetate of copper, dissolved in a mixture of 50 parts of ammonia, and 50 of alcohol, give a durable blue.

Table of British Colonies, with the date of their acquisition.

South Australia	obtained by settlement in	1836
Western Australia	" "	1829
Antigua	" "	1632
Ascension	" "	1827
Barbadoes	" "	1609
Bermuda	" "	1609
Bahamas	" "	1629
Ceylon	" capture	1795
Canada (E. and W.) ...	" "	1759
Cape of Good Hope ...	" "	1806
Columbia	" settlement	1858
St. Christopher	" "	1623
Dominica	" cession	1803
Gambia	" settlement	1631
Gibraltar (Military) ...	" capture	1704
Gold Coast	" settlement	1661
Granada	" cession	1763
St. Helena	" "	1673
Heligoland	" "	1814
Honduras	" "	1670
....	" settlement	1742
Hong Kong	" cession	1842
Indian Presidencies ...	" "	1859
Ionian Islands	" "	1814
Jamaica	" capture	1655
Labuan	" cession	1846
St. Lucia	" capture	1803
Malta	" "	1800
Mauritius	" "	1810
Montserrat	" "	1632
Natal	" settlement	1824
New Brunswick	separated from Nova Scotia	1784
Nova Scotia	obtained by settlement and capture	
Newfoundland	obtained by settlement in	1608
Nevis	" "	1628
New South Wales	" "	1728
New Zealand	" "	1839
Prince Edward's Island	" "	
Queensland ...	separated from New South Wales	1859
Sierra Leone	obtained by settlement in	1787
Tasmania	" "	1804
Tobago	" cession	1763
Trinidad	" capture	1797
Turk's & Cairo's Island,	formerly incl. in Bahamas	
St. Vincent	obtained by cession in	1763
Victoria	separated from New South Wales	1850
Virgin Islands	obtained by settlement in	1666

Cost of Relaying Rails.

It is stated by Mr. Reid, the Engineer of the Great Western of Canada, that the relaying of a mile of single line of rails in Canada, including new rails, sleepers, and joint fastenings, and a fresh supply of ballast, cannot be done, at present prices, under a cost of £1140 a mile, whereas the same could be performed in England, for £725 a mile. Rails subjected to the influences of a Canadian winter and spring, will always give way many years before the same quality of iron is worn out on an English railway.—*Eng. Journal.*

The Oil Wells of America.

The *London American* says the present yield of the wells in Pennsylvania and New York is more than 85,000,000 gallons a year. Discoveries in other States are reported and the amount produced may safely be estimated at 15,000,000 gallons more during the present year, making an estimate amount of 100,000,000 gallons to be gathered up during 1861. This oil readily sells by the wells in its crude state at 25c. per gallon, making the value of the whole amount 20,000,000 dollars. In market it sells at 40c., and when purified at 75c., making its commercial value 75,000,000 dollars, or more than £15,000,000. This oil is said to be valuable for lubricating purposes, no less than for illuminating. Should this prove the case, it will be exported largely to England. Adding this article to the United States list of exports will have a strong tendency to keep the balance of trade favourable to that country. It is now sent to Australia, and it promises to rank second only to cotton on the United States list of exports.

Consumption of Fuel by Locomotives in the U. S.

In the United States it is estimated that there are 9000 locomotives in use, their total mileage being about 175,000,000 miles. The average cost of fuel at ten cents a mile (the average in the State of New York is 18 cents) would be 17,500,000 dollars. A saving of only two cents a mile would reduce this sum to 3,500,000 dollars.

A New Alkali-Metal.—The New Metal Cæsium.

MM. Bunsen and Kirchhoff announce definitely (*Anall. der Physic und Chemie*) that they have discovered a new alkali-metal, the fourth member of the group of potassium, sodium, and lithium. At present they have only found it in very small quantities in the mineral water of Kreuznach, in the saline water of Dureckeim, and in one of the sources of the Bade—the Umgemach.

The chloride of the new metal differs from those of sodium and lithium by the yellow precipitate which it produces in the presence of bichloride of platinum. It is distinguished from potassium by its nitrate being soluble in alcohol. Introduced into a flame, and examined with a prism, the vapours of the new chloride show a very interesting spectrum, consisting of two blue lines, one of which, the fainter, almost corresponds with the blue of strontium; the other, also a well defined blue line, is situated a little further towards the violet extremity of the spectrum, and rivals the lithium line in brightness and distinctness of outline.

At the last meeting of the Chemical Society, Dr. Roscoe gave a short account of Professors Kirchhoff and Bunsen's spectrum researches, and mentioned that the new alkali-metal which they had discovered by that means had been named *Cæsium*, from the Latin word *cæsius*, signifying grayish-blue, that being the tint of the two spectral lines which it shows. By working with the residues from twenty tons of the mineral waters of Kreuznach, Professor Bunsen had succeeded in obtaining about 250 grains of the platinum salt of the new metal. Cæsium is closely allied to potassium in its chemical characters, the chief point of difference being the solubility of its nitrate in alcohol. Its equivalent number is 217,—exactly three times that of potassium. —*Chemical News.*

The Alpaca in Australia.

The Sydney (Australia) papers, are computing the value of the introduction of the Alpacca into that country. Considerable flocks of that useful animal have already been introduced to Australia Commencing in 1861 with 280 animals, of which 220 are females, and making deductions of a liberal nature, according to the present ratio of increase there would be, in fifty years, 9,760,000 head, the wool of which (an average of 7lbs.) at 2s. per lb., would amount to the sum of £6,832,000 per annum.

Those who are familiar with the extraordinary increase of the sheep in that country, will not be surprised at the results of these computations, based as they are upon observed facts.

Spontaneous Decomposition of Chloride of Lime, or Bleaching Powder.

Dr. Hoffman gives the following account of an explosion of a bottle of Chloride of Lime in the *Quarterly Journal* of the Chemical Society:—"One morning, I think it was in the summer of 1858, when entering my laboratory, which I had left in perfect order on the previous evening, I was surprised to find the room in the greatest confusion. Broken bottles and fragments of apparatus lay about, several window-panes were smashed, and all the tables and shelves were covered with a dense layer of white dust. The latter was soon found to be chloride of lime, and furnished without difficulty the explanation of this strange appearance.

"At the conclusion of the Great Exhibition of 1851, M. Kuhlmann, of Lillie. had made me a present of a splendid collection of chemical preparations which he had contributed. The beautiful large bottles were for a long time kept as a collection; gradually, however, their contents proved too great a temptation, and in the course of time all the substance had been consumed. Only one large bottle, of about 10 litres capacity, and filled with chloride of lime, had resisted all attacks; the stopper had stuck so fast that nobody could get it out; and after many unsuccessful efforts—no one venturing to indulge in strong measures with the handsome vessel—the bottle had at last found a place on one of the highest shelves of the laboratory, where for years it remained lost in dust and oblivion, until it had forced itself back on our recollection by so an energetic appeal. The explosion had been so violent that the neck of the bottle was projected in the area, where it was found with the stopper still firmly cemented into it.

"I have not been able to learn whether similar cases of the spontaneous decomposition of chloride of lime have been already observed."

Battle's Vermin-Killer

Is found to consist of flour, sugar, strychnia and Prussian blue. Ten grains of the powder furnished upon analysis 23 grains of strychnia, a quantity that represents 23 per cent. of the poison. A frog is sensibly affected by the two thousandth part of a grain of strychnia, a quantity so small as scarcely to be perceptible by the naked eye.

Writing Ink.

I.—M. de Champour and M. F. Malepeyre, in their Manual, say that Ribaucourt's ink is one of the best at present in use. The formula for its preparation, which may interest some of your readers, is as follows:—

Aleppo galls, in coarse powder......	3	ounces
Logwood chips	4	"
Sulphate of iron..........................	4	"
Powdered gum-arabic....................	3	"
Sulphate of copper.......................	1	"
Crystallised sugar	1	"

Boil the galls and logwood together in 12lbs. of water for an hour, or till half the water has been evaporated; strain the decoction through a hair-sieve, and add the other ingredients; stir until the whole, especially the gum, be dissolved; and then leave at rest for 24 hours, when the ink is to be poured off into glass bottles and carefully corked.

II.—Mr. J. Horsley, gives the following receipt:—Triturate in a mortar 36 grains of gallic acid with 3½ ounces of strong decoction of logwood, put it into an 8-ounce bottle, together with 1 ounce of strong ammonia. Next dissolve 1 ounce of sulphate of iron in half-an-ounce of distilled water by the aid of heat; mix the solutions together by a few minutes' agitation, when a good ink will be formed, perfectly clear, which will keep good any length of time without depositing, thickening, or growing mouldy, which latter quality is a great desideratum, as ink undergoing that change becomes worthless. It will not do to mix with ordinary ink, nor must greasy paper be used for writing on with it.—*Chemical News.*

To Discharge Ink.

All traces of writing ink may be obliterated by washing the paper alternately with a camel hair-brush dipped in a solution of cyanide of potassium and oxalic acid. When the ink is discharged wash the paper with rain water.

Waterproof Glue.

Fine shreds of Indian-rubber, dissolved in warm copal varnish, make a waterproof cement for wood and leather. Take glue, 12 ounces, and water sufficient to dissolve it; then add three ounces of resin, and melt them together, after which add 4 parts of turpentine. This should be done in a water bath or in a carpenter's glue-pot. This also makes a very good waterproof glue.

TO INVENTORS AND PATENTEES IN CANADA

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside,

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

THE JOURNAL
OF THE
Board of Arts and Manufactures,
FOR UPPER CANADA.

APRIL, 1861.

THE PRODUCTION OF SILK FROM THE CATERPILLARS OF CANADIAN MOTHS.

For several years past the attention of naturalists and others in Europe, has been directed to the possibility of discovering some silk-producer, as a substitute for the ordinary silk-worm. Various epidemics have recently been making great havoc among the silk-worms, so much so, that during the last few years, half, or nearly two-thirds, of the crop in Europe has been lost through these causes, to the great alarm of those engaged in this branch of industry. In a late number of the "Illustrated London News," a brief account is given of the discovery of a new silk-producing moth (*Saturnia cynthia*), the caterpillar of which feeds on the leaves of the tall Ailanthus (*Ailanthus glandulosus*), a tree indigenous to China, but which has recently been introduced into and acclimatized in England. The silk obtained from this moth is described as being strong, as taking most dyes well, being cheaply produced, and as only lacking the more brilliant lustre of the best silks on which we have been so long accustomed to look. Now it is well known to naturalists that there exist in Canada several native species of this genus (*Saturnia*) of moths, some of which resemble very closely the one mentioned above. It is desired in the following paper, to draw attention to the possibility of employing the products of these moths in the manufacture of, at any rate, the coarser varieties of silk.

The subject is by no means new in Canada, the attention of naturalists having been early attracted by the splendor of the Saturniæ and the extraordinary quantity of silk they produce in forming their cocoons. Dr. Cottle, of Woodstock, read some notes on this genus of moths before the Canadian Institute in 1854,* suggesting the possibility of using their silk for textile fabrics.

All the silk and silk-stuffs of commerce are obtained at present from the common silk-worm (*Bombyx mori*); but in Bengal, and other parts of India, and to a large extent in China, valuable silk is procured from the cocoons of other species of moths, of these the most important known are the *tussah* and Arindy silk-worms. The first (*Phalæna paphia, Roxb.*) occurs in such abundance over many parts of Bengal and the adjoining provinces, as to have afforded to the natives, from time immemorial, an abundant supply of a very durable, and dark coloured silk, called *tussah*. This fabric is much worn by the Brahmins, and other sects of the Hindoos, and would no doubt, be very useful in America, as affording a cheap and at the same time very durable dress. The second, the Arindy silk-worm, is found in many parts of Bengal, where it is reared in a domestic state. Its food consists of the leaves of the common *Ricinus*, or palma-christi, called Arindy by the natives. The silk manufactured from the cocoons of this moth is of an almost incredible durability: it is said that a dress made of it lasts more than the lifetime of one person, and is frequently handed down from parent to child. The Chinese have also many wild species of silk-worm, which feed on the oak, ash, pepper-tree, and various others.

The Canadian species of the genus to which the above mentioned insects belong—the *Saturnia*, Schr., or *Attacus*, Hübner, as now constituted—are very fine insects, and spin large cocoons. This genus of large moths is, perhaps, the most handsome of all the nocturnal lepidoptera: they are beautifully covered with a soft down and are adorned with a great variety of splendid colours. The first of these is the Cecropia moth (*Saturnia cecropia*, Linn.,) the largest of the Canadian lepidoptera, not uncommon in any part of Canada. Its wings, when expanded, measure from six to seven inches in breadth; their ground colour is dusky-brown. The anterior pair are adorned near the middle, with a kidney shaped, reddish-white spot margined with black; and beyond this, nearer the edge, with a reddish-white, slightly wavy, band bordered with black; the rest of the wing is of a rather lighter colour, becoming a light brown at the edge. Near the tip there is also a black eye-like spot, and a short zig-zag line of a whitish colour, running from it to the front of the wing. The posterior wings are of the same colour, and ornamented in much the same way; the band is rather broader, and of a lighter hue, as is also the kidney-shaped disk in the middle. The head is red, with a white collar between it and the thorax, which is also red. The abdomen is of a rather darker red, and is marked with white transverse lines. The antennæ of the male are broadly pectinated, of the female much less so.

The caterpillar is almost as beautiful as the perfect insect. Its length is from three to four inches; it is of a light green colour, with a number of light red, or yellow, wart-like points, projecting from it. On each segment there are two small blue spots. It feeds on the leaves of the apple, cherry, and plum trees; the first of which appears to be its favorite

* A few rough notes on some of the Canadian Saturniæ, and suggestions on the possibility of using their silk for textile purposes.—*Canadian Journal*, Vol. II., Old Series.

food. It remains on the trees, feeding on the leaves, until August or September, when it descends, and may often be seen crawling about in search of a convenient situation in which to construct its cocoon. It spins a brownish coloured cocoon, about three inches long, and one wide, which it attaches firmly to the under side of a twig. The outer coat is coarse and very strong, and affords an excellent protection to the chrysalis from the inclemency of the weather even in our severest winters. The inside of this outer integument is lined with soft, though strong brown silk, which may be unwound and spun like that of the ordinary silk-worm. In the inside lies a large black, shining chrysalis, from which the moth issues in due time. These cocoons remain on the trees until about the end of May. When about to emerge from its shell the moth throws out a caustic liquid from its mouth, which dissolves the fibres of the silk, and enables it to escape from its prison. These insects may be very easily raised from the caterpillars by placing them in a spacious box, with a little moistened earth at the bottom, and keeping them supplied with food,—if the food is allowed to become withered or mouldy, of course the caterpillars cannot be expected to retain their health. The box should be covered with a gauze or wire frame, and there should also be fastened in it some twigs on which the insect may spin its cocoon. An excellent plan is to get a glass cylinder and sink one end of it into a flower-pot in which is some white sand, the sand is kept moist and the food is stuck into it, so as to keep it fresh for some time ; the caterpillar is then placed on its food, a bit of gauze is tied over the top of the cylinder, and the flower-pot and cylinder being kept out of doors, the insect is as nearly as possible in a state of nature. That these moths may be successfully raised from the eggs also, we learn from the "Transactions of the American Philosophical Society of Philadelphia," vol. 1 ; where we are told that as early as the year 1767, "Moses Bartrain, of Philadelphia, raised a number of caterpillars from the eggs of the Cecropia moth, from which he also obtained cocoons." It is stated in the "Philosophical transactions of the Royal Society of London," for the year 1759, that "the Rev. Samuel Pullein was among the first to attempt to unwind the cocoons of this moth ;" and that "he ascertained that twenty threads of this silk, twisted together would sustain nearly an ounce in weight more than the same number of common silk." Dr. Thaddeus Harris, in his treatise on the insects of Massachusetts injurious to vegetation, remarks on this subject:—"The following circumstances seem particularly to recommend these indigenous silk-worms to the attention of persons interested in the silk culture. Our native trees afford an abundance of food for the caterpillars: their cocoons are much heavier than those of the silk-worm, and will yield a greater quantity of silk; and as the insects remain unchanged in the chrysalis state from September to June, the cocoons may be kept for unwinding at any leisure time during the winter. Consisting, as these cocoons do, entirely of silk, the fibres of which far surpass those of the silk-worm in strength, they might be employed in the formation of fabrics similar to those manufactured in India. Experiments have been made with the silk of the Cecropia, which has been carded and spun, and woven into stockings that wash like linen."

The *Saturnia polyphemus*, Fabr. is another of these silk-producing moths. Its wings expand to five or six inches; they are of a yellowish-brown colour, clouded with black; each wing is ornamented with a transparent eye-like spot. The anterior one is marked with a waved line near the edge, two small black spots at the tip, contiguous to each other, and two curved lines of a light colour at the base, near the body of the insect. The transparent spot—near the middle—is encircled with yellow and black. The posterior wing is of much the same colour,—in the male of a darker shade,—with a continuation of the marginal band, which has on this wing, a broad border of black. The transparent spot is larger, and forms the pupil, as it were, of a large eye-like spot, the iris of which is bluish grey, gradually shading into black, the whole surrounded with a deep black border. The body is of the same colour as the wings. The female is very similar to the male, except that the colours are of a lighter shade. The caterpillar is about two inches and a half in length, and about half an inch in diameter; it is of a light green colour, nearly transparent; each segment of the body rises into two humps, terminating in a little bright yellow wart, bearing two or three short hairs. Along each side there are two rows of similar wart-like excrescences, which are joined, on each segment by an oblique yellow line. Its head and feet are dark brown. It feeds on the leaves of the choke-cherry, and other species of *prunus*, and also according to some writers, on the oak and elm. When full grown, the caterpillar draws together several leaves of the tree on which it feeds, with its silken threads, and forms within them an oblong cocoon, about two inches long, rounded at the ends, and very firm, which contains much silk, somewhat similar to that of the Cecropia moth, though not in so large a quantity. The perfect insect, after having remained in the imago state all winter, emerges from the cocoon in July or August. The other Canadian species are the *Saturnia promethea*, Drury, and the *S. luna*, Drury ; both spin cocoons containing silk, though not as much as the others mentioned above. The caterpillar of the *Promethea* feeds on the sassafras, and the common wild cherry; that of the *Luna* on the walnut, and hickory trees.

Of these insects the *Cecropia* will probably be found to be the most useful, as it is easiest to raise, is the largest, and produces the most silk.

The results of all the most approved modes of rearing the silkworm and preparing the cocoons, were exhibited, and might be studied with advantage, in the Crystal Palace, during 1851.

"The *Bombyx mori*, having been bred and reared under the special care and management of man during a long succession of ages, may be regarded as a domesticated species of insect; and it has become the subject, as in the higher domesticated races, of varieties, of which those called "Sina," "Syrie," and "Novi," in France, are examples.

"The Sina" variety of the silkworm is known and esteemed for the pure whiteness of its silk, the thread of which is fine, but weak, and not very lustrous. The "Syrie" variety is of large size, produces a cocoon abundant in silk, but the thread is rather coarse, and inclines to a greenish tint. The "Novi" race is small, but the cocoons are firm and well made, and the silk has a yellowish tint.

The specimens of cocoons and raw silk exhibited in the French department were numerous, and the degrees of excellence hardly to be discriminated in the finest examples selected for the award of the prize medal. With regard to the superior quality of these raw silks and cocoons, the Jury, by their recommendation of the award of the Council medal to the "Central Society of Sericiculture of France," desired to testify their admiration of the specimens exhibited by many members of that Society, and their appreciation of the important influence which it has exercised in the improvement of this valuable product of the animal kingdom.

The Jury, however, justly gave the honour of their first notice to the beautiful specimens shown by Major Count de Bronno Bronski, exhibitor of unbleached silk and silk cocoons from the Château de St. Selves, near Bordeaux, Department de la Gironde. The cocoons were remarkable for their large size and regularity of form, and the silk for the unusual length of the thread, its natural pure white colour, its fineness and lustre. The circumstances under which this superior quality of silk were obtained are certified in a report by a Committee of the Agricultural Society of the Gironde, dated 28th April, 1847, to be as follows:—"In 1836 Major Bronski reared separately the eggs of the three varieties, 'Sina,' 'Syrie,' and 'Novi.' In 1827 he set apart the cocoons of the varieties, 'Syrie' and 'Novi;' and on the exclusion of the imago, or perfect insect, he associated the males of the 'Novi' with the females of the 'Syrie;' and the hybrid ova were hatched at the ordinary period in 1838, the operations being repeated in 1839 and 1840. With regard to the race 'Sina,' M. Bronski, in 1837, separated the white from the black worms as soon as they were hatched. He then selected the largest and best shaped cocoons, and made a special collection of the eggs from the moths excluded from those cocoons. This procedure was repeated in 1838 and 1839; but in 1840 he associated the males excluded from the large cocoons of the black worms with the females excluded from those of the white worms. In 1841, he associated the males of the 'Sina' race with the hybrid females obtained from the above-described crossings of 'Novi' and 'Syrie' breeds." By these and similar experiments M. Bronski at length appears to have succeeded in obtaining a race of silkworms not subject to disease, producing large and equal-sized cocoons of a pure white colour, the silk of which was equal in all its length, strong and lustrous, and presenting an average length of thread of 1057 mètres."

A few statistics are subjoined to show the very great importance of the manufacture of silk. From official returns, it is found that there were imported into Great Britian and Ireland during the year 1858:

Raw silk	6,277,676lbs. valued at	£5,791,216
Thrown silk.	358,269lbs. " "	457,866

Manufactured silk goods, from India 207,081 pieces.
" " from Europe 827,650 lbs.

The customs duties paid on these amounted to no less than £270,536.

In the same year, there were exported from England:

Raw silk	2,814,519lbs.
Thrown silk (foreign)	364,680 "
Manufactured silk goods (European)	18,092 "
" " (Indian)	227,139 pieces.
" " (English) 480,709lbs valued at	£603,399
Thrown silk (Eng.) 551,281lbs. valued at	£562,002
Silk twist " 442,641 " " "	928,644

The average weight per annum of raw and thrown silks imported into England in the years 1856–8, was 11,266,618lbs.

The returns of the silk trade for 1859, in England, amounted to £14,000,000; France, £31,300,000; Zollverein, £4,105,000; Switzerland, £4,000,000; Austrian States, £7,200,000; Spain, Italy, &c., £5,000,000. So that the total returns of the silk-manufactures in Europe amount to the enormous sum of £65,605,000.

In the year 1855, there was imported into the United States, over twenty-five million of dollars' worth of silk, from Italy, France and China, viz:—

Of raw silk	$751,623
Of manufactured silk	$24,916,356

The value of the importations of silks of all kinds into Canada in 1857 amounted to $1,025,839. In 1858 it sunk to $658,045, and in 1859 rose to $901,856. A consumption which may now be assumed as fully equal to one million dollars a year, ought to supply a stimulant, which would lead many who have time at their disposal, to direct their attention to this interesting and important subject, and by practical experiment establish the feasibility of producing Canadian silk from Canadian silk-worms. It would be a very valuable and most interesting contribution to the International Exhibition of 1862, if a specimen of Canadian manufactured silk, with moths, worms, cocoons, and leaves of the trees they usually feed on, were to be prepared for exhibition.

COTTON MANUFACTURES.

"From one of the most miserable provinces in the land, Lancashire has grown to be one of the most prosperous. Within a hundred and fifty years the population has increased tenfold, and land has risen to fifty times its value for agricultural, and seventy times for manufacturing purposes. From an insignificant country town and a little fishing village, have sprung Manchester and Liverpool; and many other towns throughout the country owe their existence to the same source. These are the great monuments to the achievements of Arkwright, Crompton, Peel, and the other captains of industry who wrought this mighty change, and the best trophies of their genius and enterprize."

Cotton was but little used in Great Britain until the middle of the eighteenth century. The history of its establishment as an industrial staple is fraught with sad and humiliating incidents, reflecting disgrace upon the authors of the ingratitude and treachery which were the rewards of some of the earlier inventors of the machinery from which it derived all its importance and power. To other well known families it has been the means of securing enormous wealth, and even exalted rank; while to the British nation, cotton has been one of the chief sources of preëminence and power. Who would have thought, when Hargreaves constructed his first spinning frame ("jenny"), in 1767, that in less than a century a single firm would be *printing* calicos at the rate of a mile an hour, or turning out ten thousand miles of the same article in a year? In 1811 there were 4.600,000 of Crompton's mule-spindles in use. At the present day there are 30,000,000 mule-spindles actively employed in Great Britain alone, and the increase goes on at the rate of 1,000,000 a-year. One English firm manufactures mules at the rate of 500,000 annually.

But it is the enormous amount of capital expended in maintaining the manufacture of cotton, and the vast number of persons to whom it gives employment, directly or indirectly, that excites the astonishment and almost terror of every one who seriously studies the subject, and contemplates the calamity which would result, if a disease like the oidium of the grape vine should strike the cotton plant.

It is estimated by very competent authorities* that the capital employed in cotton manufactures in the United Kingdom, exceeds £50,000,000; that in the machinery establishments and other work-shops supplying the machinery, £50,000,000 more is invested; making in all £100,000,000 sunk in the trade. There are not less than half a million persons employed directly in the cotton mills, and one million and a half are dependent upon these workers; making two millions immediately dependent upon this manufacture, besides an additional two millions engaged in trades which supply the cotton manufacturers with their machinery;—hence there are four millions of persons in the United Kingdom entirely dependent upon the stability and progress of the cotton trade! These estimates do not include numerous other collateral branches, which swell the number of those directly or indirectly interested—deriving an income from it, or being wholly dependent on cotton—to one-sixth of the population of Great Britain and Ireland, or considerably more than the aggregate population of British North America.

* See *Journal of the Society of Arts*, Dec. 24, 1858.

The effect of the cotton trade and manufacture on Lancashire has already been noticed; but so astonishing is the result, that a few additional statistics on this important subject may be introduced with propriety and advantage.

In 1758, the population of Manchester was only 20,000—less than half that of Toronto at the present time. In 1858 it exceeded 500,000. The inhabitants of the county (Lancashire) amounted, in 1758, to 300,000; now it embraces 2,300,000 souls. The tonnage of Liverpool, in 1758, was 100,000 tons; in 1858, or one hundred years later, it had risen to 5,000,000 tons. Cotton has been mainly instrumental in producing this extraordinary increase.

An idea of the rapid increase in the manufacture of cotton fabrics in England may be gathered from the following figures.

1857.	
Cottons, Calicoes, &c.............	1,979,000,000 yards.
Value	£28,786,000
Yarns and Laces..................	8,700,000
	£37,486,000
1858.	
Cottons, Calicoes, &c.............	2,321,000,000 yards.
Value	£32,042,000
Yarns and Laces..................	9,579,000
	£41,621,000
1869.	
Cottons, Calicoes, &c.............	2,563,000,000 yards.
Value	£37,040,000
Yarns and Laces..................	9,465,000
	£46,505,000

In two years England has added twenty-five per cent. to her exports of cotton goods, yarns, &c.

The cotton crops in the United States amounted in 1849-50 to 2,096,706 bales, with a value of $117,649,947. In 1859-60 the crop reached the enormous quantity of 4,669,770 bales, having a value of $308,865,280.

The statistics will enable any one to understand the nature and extent of the anxiety which is now being manifested in Europe, respecting the continuation of the supply of the raw material from the cotton-growing States of the new Confederacy of the South, and the reason why men are so earnestly directing their attention to Africa and India, and speculating upon the probability of obtaining a supply from those regions, in case prospective troubles on this continent should diminish the amount available for exportation, or check that annual increase which the progress of the manufacture in Europe requires for its continuance.

In all European countries where any pretensions to manufacturing industry are put forth, cotton holds a prominent place; and it is worthy of remark, especially by Canadians at the commencement as it were of a new industrial career, that an able critic upon the displays at the Palace of Industry in 1855, gave it as his deliberate opinion, that "THE DEGREE OF ADVANCEMENT OF EACH PEOPLE IN THE CAREER OF INDUSTRY MIGHT BE MEASURED BY ITS SKILL IN THE TREATMENT OF COTTON."*

The steps which are now being taken in Toronto and elsewhere throughout Canada to encourage the development of this important industry, are fraught with the greatest importance to our future interests and welfare. It is one of the more encouraging and hopeful signs of the times that, while enterprising capitalists are willing to bring their means and energies to bear upon the establishment of cotton manufactories in our midst, municipal corporations are not less willing and anxious to give every reasonable encouragement to the enterprize. Under judicious management no one can doubt that the result will be most favourable to our industrial progress; and besides giving direct employment to a portion of our population most in need of it, it will induce the immigration of skilled artizans, attract the attention of foreign capitalists, give rise to numerous collateral branches of industry which will rapidly contribute to the wealth of the country, and the development of many of the hitherto unapplied resources with which nature has so abundantly furnished us.

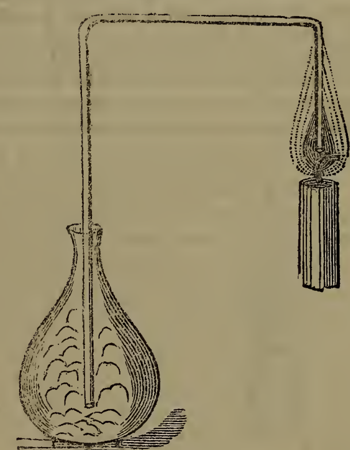
CHEMICAL HISTORY OF A CANDLE.

BY M. FARADAY, D.C.L., F.R.S.

From the Chemical News Jan. 12th 1861.

LECTURE II.—A CANDLE: BRIGHTNESS OF THE FLAME—AIR NECESSARY FOR COMBUSTION—PRODUCTION OF WATER.

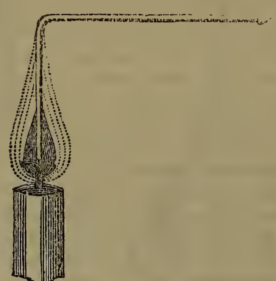
We were occupied the last time we met in considering the general character and arrangement as regards the fluid portion of a candle, and the way in which that fluid got into the place of combustion. You see, when we have a candle burning fairly in a regular steady atmosphere it will have a shape something like the one shown in the diagram, and looking pretty uniform, although very curious in its character. And, now, I have to ask your attention to the means by which we are able to ascertain what happens in any particular part of the flame; why it happens; what it does in happening; and where, after all, the whole candle goes to: because, as you know very well, a candle being brought before us and burned, disappears, if burned properly, without the least trace of dirt in the candlestick—and this is very curious circumstance. Now, in order to examine this candle carefully, I have arranged certain apparatus, the use of which you will see as I go on. Here is a candle; I am about to put the end of this glass tube into the middle of it—into that part which old Hooker has represented in the diagram as being rather dark, and which you can see at any time if you will look at a candle carefully, without blowing it about. We will examine this dark part first.



Now, I take this bent glass tube, and introduce one end into that part of the flame, and you see at once that something is coming from the flame, out at the other end of the tube; and if I put a flask there, and leave it for a little while you will gradually see that something from the middle part of the flame is drawn out and goes through the tube and into that flask, and there behaves very differently from what it does in the open air. It not only escapes from the end of the tube, but falls down to the bottom of the flask like a heavy substance, as indeed it is. We find that this is the wax of the candle made into a vaporous fluid—not a gas.—(You must learn the difference between a gas and a vapour: a gas remains permanent, a vapour is something that will condense.)—If you blow out a candle, you perceive a very nasty smell, consequent on the condension of this vapour That is very different from what you have outside the flame; and, in order to make that more clear to you, I am about to produce and set fire to a larger portion of this vapour—for what we have in the small way in a candle, to understand thoroughly, we must, as philosophers, produce in a larger way if needful, that we may examine the different parts. And, now, Mr. Anderson will give me a source of heat; and I am about to show you what that vapour is. Now, here is a glass flask, and I am going to make it hot, as the inside of that candle-

* M. Audiganne.

flame is hot, and the matter about the wick is hot. [The Lecturer placed some pieces of wax in a glass flask, and heated them over a lamp.] Now, I dare say, that is hot enough for me. You see that the wax I put in it has now become fluid, and there is a little smoke coming from it. We shall very soon have the vapour rising up. I will make it still hotter, and now we get more of it, so that I can actually pour the vapour out of the flask into that basin, and set it on fire there. This, then, is exactly the same kind of vapour as we have in the middle of the candle; and that you may see that that is the case, let us try whether we have not got here, in this flask, a real combustible vapour out of the middle of the candle.—[Taking the flask into which the tube from the candle proceeded, and introducing a lighted taper.]—See how it burns. Now this is the very vapour from the middle of the candle, produced by its own heat; and that is one of the first things you have to consider with respect to the progress of the wax in the process of combustion, and as regards the changes it undergoes. I will arrange another tube carefully in the flame, and I should not wonder if we were able, by a little care, to get that vapour to pass through the tube to the other extremity, where we will light it, and obtain absolutely the flame of the candle at a place distant from it. Now, look at that. Is not that a very pretty experiment?



Talk about laying on gas—why, we can actually lay on a candle! And you see from this that there are clearly two different kinds of action—one the *production* of the vapour, and the other the *combustion* of it —both of which take place in particular parts of the candle.

I shall get no vapour from that part that is already burned. If I raise the tube (Fig. 1) to the upper part of the flame, so soon as the vapour has been swept out, what comes away will be no longer combustible; it is already burned. How burned? Why burned thus: in the middle of the flame where the wick is, there is this combustible vapour; on the outside of the flame is the air which we shall find necessary for the burning of the candle; between the two, intense chemical action takes place whereby the air and the fuel act upon each other, and at the very same time that we obtain light the vapour inside is destroyed. If you examine where the heat of a candle is, you will find it very curiously arranged. Suppose I take this candle and hold a piece of paper close upon the flame, where is the heat of that flame? Do you not see that it is *not* in the inside? It is in a ring, exactly in the place where I told you the chemical action was; and even in my irregular mode of making the experiment, if there is not too much disturbance, there will always be a ring. This is a good experiment for you to make at home. Take a strip of paper, have the air in the room quiet, and put the piece of paper right across the middle of the flame,—(I must not talk while I make the experiment,)—and you will find that it is burnt in two places, and that it is not burnt, or very little so, in the middle; and when you have tried the experiment once or twice, so as to make it nicely, you will be very interested to see where the heat is, and to find that it is where the air and the fuel come together.

This is most important for us as we proceed with our subject. Air is absolutely necessary for combustion; and what is more, I must have you understand that *fresh* air is necessary, or else we should be imperfect in our reasoning and our experiments. Here is a jar of air, I place it over a candle, and it burns very nicely in it at first, showing that what I have said about it is true; but there will soon be a change. See how the flame is drawing upwards, presently fading and at last going out. And going out, why? Not because it wants air merely, for the jar is as full now as it was before; but it wants pure, fresh air. The jar is full of air, partly changed, partly not changed; but it does not contain sufficient of the fresh air which is necessary for the combustion of a candle. These are all points which we as young chemists have to gather up; and if we look a little more closely into this kind of action, we shall find certain steps of reasoning extremely interesting. For instance, here is the oil-lamp I showed you,—an excellent lamp for our experiments,—the Old Argand lamp. I now make it like a candle [obstructing the passage of air into the centre of the flame]; there is the cotton; there is the oil rising up it; and there is the conical flame. It burns poorly because there is a partial restraint of air. I have allowed no air to get to it, save round the outside of the flame, and it does not burn well. I cannot admit more air from the outside, because the wick is large; but if, as Argand did so cleverly, I open a passage to the middle of the flame, and so let air come in there, you will see how much more beautifully it burns. If I shut the air off, look how it smokes; and why? We have now some very interesting points to study: we have the case of a combustion of a candle; we have the case of a candle being put out by the want of air; and we have now the case of imperfect combustion, and this is to us so interesting, that I want you to understand it as thoroughly as you do the case of a candle burning in its best possible state. I will now make a great flame, because we need the largest possible illustrations. Here is a larger wick [burning turpentine on a ball of cotton]. All these things are the same as candles, after all. If we have larger wicks we must have a larger supply of air, or we shall have less perfect combustion. Look now at this black substance going up into the atmosphere; there is a regular stream of it. I have provided means to carry off the imperfectly-burned part, lest it should annoy you. Look at the soots that fly off from the flame: see what an imperfect combustion it is because it cannot get enough air. What, then, is happening Why, certain things which are necessary to the combustion of a candle are absent, and very bad results are accordingly produced; but we see what happens to a candle when it is burnt in a pure and proper state of air. At the time when I showed you this charring by the ring of flame on the one side of the paper, I might also have shown you, by turning to the other side, that the burning of a candle produces the same kind of soot—charcoal, or carbon.

But, before I show that, let me explain to you, as it is quite necessary for our purpose, that though I take a candle and give you, as the general result, its combustion in the form of a flame, we must see whether combustion is always in this shape,—when I say "shape" I mean condition,—or whether there are other conditions of flame; and there are, and they are most important to us. I think perhaps the best illustration of such a point as that, being young ones, is to give you the result of strong contrast. Here is a little gunpowder. You know that gunpowder burns with flame; we may fairly call it flame. It contains carbon and other materials, which altogether cause it to burn with a flame. And here is some pulverised iron, or iron filings. Now, I purpose burning these two things together. I have a little mortar in which I will mix them. (Before I go into these experiments, let me hope that none of you, by trying to repeat them, for fun's sake, will do any harm. These things may all be very properly used if you take care, but, without that, much mischief will be done.) Well, then, here is a little gunpowder, which I put at the bottom of that little wooden vessel, and mix the iron fillings up with it, my object being to make the gunpowder set fire to the filings and burn them in the air, and thereby show the difference between the substances burning with flame and not with flame. Here is the mixture, and when I set fire to it you must watch the combustion and you will see that it is of two kinds. You will see the gunpowder burning with a flame and the filings thrown up. You will see them burning too, but you will see them burning otherwise than in flame. They will each burn separately. [The Lecturer then ignited the mixture.] There is the gunpowder, which burns with a flame, and there are the filings: they burn with a different kind of combustion. You see, then, these two great distinctions; and upon these differences depend all the utility and all the beauty of flame which we use for the purpose of giving out light. When we use oil, or gas, or candle, for the purpose of illumination, their fitness all depends upon these different kinds of combustion.

There are such curious conditions of flame that it requires some sharpness and some cleverness to distinguish the kinds of combustion one from another. For instance, here is a powder which is very combustible, consisting, as you see, of separate little particles. It is called *lycopodium*, and each of these particles can produce a vapour, and produce its own flame; but to see them burn you would think it was all one flame. I will now set fire to a quantity and will see the effect. We saw a cloud of flame, apparently in one body; but that rushing noise [referring to the sound produced by the burning] was a proof that the combustion was not a continuous or regular one. This is the lightning of the pantomines, and a very good one too. [The experiment was twice repeated by blowing *lycopodium* from a glass tube through a spirit flame.] That is not a combustion like that of the filings I have been speaking of, to which I must now bring you back again.

Supposing I take a candle and examine it in that part which appears brightest to our eyes. Why, there I get these black particles, which already you have seen three or four times evolved from the flame, and which I am now about to evolve in a different way. I will take this candle and clear away the gutterage which occurs by reason of the currents of air; and if I now arrange a glass tube so as just to dip into this luminous part, as in our first experiment, only higher, you see the result. In place of having the same white vapour that you had before, you will now have a black vapour. There it goes, as black as ink. It is certainly very different from the white vapour, and when we put a light to it you will find that it does not burn, but that it puts the light out. Well, these particles, as I said before, are just the smoke of the candle; and this brings to mind that old employment which Dean Swift recommended to servants for their amusement, namely, writing on the ceiling of a room with a candle. But what is that black substance? Why, it is the same carbon which exists in the candle. How comes it out of the candle? It evidently existed in the candle, or else we should not have had it here. And now I want you to follow me in this explanation. You would hardly think that all those substances which fly about London, in the form of soots and blacks, are the very beauty and life of the flame, and which are burned in it as those iron filings were burned here. Here is a piece of wire-gauze, which will not let the flame go through it, and I think you will see, almost immediately, that when I bring it low enough to touch that part of the flame which is otherwise so bright that it quells and quenches it at once, and allows a volume of smoke to rise up.

I want you now to follow me in this point,—that whenever a substance burns, as the iron filings burnt in the flame of gunpowder, without assuming the vaporous state,—they may become liquid or they may remain solid,—they become exceedingly luminous. I have here taken three or four cases away from the candle, on purpose to illustrate this point to you; because, what I have to say is applicable to all substances, whether they burn or whether they do not burn,—that they are exceedingly bright if they retain their solid state, and that it is to this presence of solid particles in the candle that it owes its brilliancy.

Here is a platinum-wire which does not change by heat. If I heat it in this flame see how exceedingly luminous it becomes. I will make the flame dim for the purpose of giving a little light only, and yet you will see that the heat which it can give to that platinum-wire, though far less than the heat it has itself is able to raise the platinum-wire to a far higher state of effulgence. This flame has carbon in it; but I will take one that has not carbon in it. There is a material, a kind of fuel—a vapour, or gas, which ever you like to call it—in that vessel, and it has no solid particles in it; so I take that because it is an example of flame itself burning without any solid matter whatever; and if I now put this solid substance in it, and you see what an intense heat it has, and how brightly it causes the solid body to glow. This is the pipe through which we convey this particular gas, which we call hydrogen, and which you shall know all about next time we meet. And here is a substance called oxygen, by means of which this hydrogen can burn; and although we produce, by their mixture, far greater heat than you can get by the candle, yet there is very little light. If, however, I take a solid substance, and put that into it, we get a great light. If I take a bit of lime, which is a thing which will not burn, and which will not vaporise by the heat, and because it does not vaporise remains solid, and remains heated, you will find what happens as to the glowing of it. I have a most intense heat here produced by the burning of the hydrogen in contact with the oxygen; but there is as yet very little light—nor for want of heat, but for want of particles which can retain their solid

state; but when I hold this piece of lime in the flame of the hydrogen as it burns in the oxygen, see how it glows! This is the glorious lime-light, which rivals the voltaic-light, and which is almost equal to the sun-light. I have here a piece of carbon or charcoal which will burn and give us light exactly in the same manner as if it were burnt as part of a candle. The heat that is in the flame of a candle decomposes the vapour of the wax and sets free the carbon particles; they rise up heated and glowing as this now glows, and then enter into the air. But the particles when burnt never pass off from a candle in the form of carbon. They go off into the air as a perfectly invisible substance, about which we shall know hereafter.

Is it not beautiful to think that such a process is going on, and that such a dirty thing as charcoal can become so incandescent? You see it comes to this—that all bright flames contain these solid particles; all things that burn and produce solid particles, either during the time they are burning, as in the candle, or immediately after being burnt, as in the case of the gunpowder and iron-filings, all these things give us this glorious and beautiful light.

I will give you a few illustrations. Here is a piece of phosphorous, which burns with a bright flame. Very well; we may now conclude that phosphorus will produce, either at the moment that it is burning or afterwards, these solid particles. Here is the phosphorus lighted, and I cover it over with this glass for the purpose of keeping in what is produced. What is all that smoke? That smoke consists of those very particles which are produced by the combustion of the phosphorous. Here again are two substances. This is chlorate of potassa, and this is sulphuret of antimony. I shall mix these two things a little, and then they may be burnt in many ways. I shall touch them with a drop of sulphuric acid, for the purpose of giving you an illustration of chemical action, and they will instantly burn. [The Lecturer then ignited the mixture by means of sulphuric acid.] Now, from the appearance of things you can judge whether they produce solid matter in burning. I have given you the train of reasoning which will enable you to say whether they do or do not. And what is this bright flame but the solid particles passing off?

Mr. Anderson has in the furnace a pretty hot crucible,—I am about to throw into it some zinc filings, and they will burn with a flame like gunpowder. I make this experiment because you can make it well at home. Now, I want you to say what will be the result of the combustion of this zinc. Here it is burning—burning beautifully like a candle, I may say. But what is all that smoke, and what are those little clouds of wool which will come to you if you cannot come to them, and make themselves sensible to you in the form of the old philosophic wool, as it was called? We shall have left in that crucible, also a quantity of this woolly matter. But I will take a piece of this same zinc and make an experiment a little more closely at home, as it were. You will have here the same thing happening. Here is the piece of zinc; there [pointing to a jet of hydrogen] is the furnace, and we will set to work and try and burn the metal. It glows, you see; there is the combustion; and there is the white substance into which it burns. And so if I take that flame of hydrogen as the representative of a candle, and show you a substance like zinc burning in the flame, you will see that it was merely during the action of combustion that this substance glowed—while it was kept hot; and if I take a flame of hydrogen and put this white substance from the zinc into it, look how beautifully it glows, and just because it is a solid substance.

I will now take such a flame as I had just now and set free from it the particles of carbon. Here is some camphine, which will burn with a smoke; but if I send these particles of smoke through this pipe into the hydrogen flame you will see that they will burn and become luminous, because we heat them a second time. There they are. Those are the particles of carbon re-ignited a second time. They are those particles which you can easily see by holding a piece of paper behind them, and which, whilst they are in the flame, are ignited by the heat produced, and, when so ignited, produce this brightness. When the particles are not separated you get no brightness. The flame of coal-gas owes its brightness to the separation, during combustion, of these particles of carbon, which are equally in that as in a candle. I can very quickly alter that arrangement. Here, for instance, is a bright flame of gas. Supposing I add so much air to the flame as to cause it all to burn before these particles are set free, I shall not have this brightness; and I can do that in this way:—If I place over the jet this wire-gauze cap, as you see, and then light the gas over it, it burns with a non-luminous flame, owing to its having plenty of air mixed with it before it burns; and if I raise the gauze up, you see it does not burn below. There is plenty of carbon in the gas; but, because the atmosphere can get to it and mix with it before it burns, you see how pale and blue the flame is. And if I blow upon a bright gas-flame, so as to consume all this carbon before it gets heated to the glowing point, it will also burn blue. [The Lecturer illustrated his remarks by blowing on the gas-light.] The only reason why I have not the same bright light when I thus blow upon the flame is, that the carbon meets with sufficient air to burn it before it gets separated in the flame in a free state. The difference is solely due to the solid particles not being separated before the gas is burnt.

You observe that there are certain products as the result of the combustion of a candle; and that of these products one portion may be considered as charcoal, or soot; that charcoal, when afterwards burnt, produces some other product; and it concerns us very much now to ascertain what the other product is. We showed that something was going away; and I want you now to understand how much is going up into the air; and for that purpose we will have combustion on a little larger scale. From that candle ascends heated air, and two or three experiments will show you the ascending current; but, in order to give you a notion of the quantity of matter which ascends in this way, I will make an experiment by which I shall try to imprison some of the products of this combustion. For this purpose I have here what boys call a fire-balloon; I use this fire-balloon merely as a sort of measure of the result of the combustion we are considering; and I am about to make a flame in such an easy and simple manner as shall best serve my present purpose. This plate shall be the "cup," we will say, of the candle; this spirit shall be our fuel; and I am about to place this chimney over it, because it is better for me to do so than let things proceed at random. Mr. Ander-

son will now light the fuel, and here at the top we shall get the results of the combustion. What we get at the top of that tube is exactly the same, generally speaking, as you get from the combustion of a candle; but we do not get a luminous flame here, because we use a substance which is feeble in carbon. I am about to put this balloon—not into action, be cause that is not my object, but to show you the effect which results from the action of those products which arise from the candle, as they arise here from the furnace. [The balloon was held over the chimney, when it immediately commenced to fill.] You see how it is disposed to ascend; but we must not let it up, because it might come in contact with those upper gas-lights, and that would be very inconvenient. [The upper gas-lights were turned out at the request of the lecturer, and the balloon was allowed to ascend.] Does not that show you what a large bulk of matter is being evolved? Now, there is going through this tube [placing a large glass tube over a candle] all the products of that candle, and you will presently see that the tube will become quite opaque. Suppose I take another candle and place it under a globe, and then put a light on the other side, just to show you what is going on. You see that the sides of the jar become cloudy and the light begins to burn feebly. It is the products you see, which makes the light so dim, and this is the same thing which makes the sides of the jar so

opaque. If you go home and take a spoon that has been in the cold air and hold it over a candle—not so as to soot it—you will find that it becomes dim just as that jar is dim. If you can get a silver dish, or something of that kind, you will make the experiment still better: and now just to carry your thoughts forward to the time we shall next meet, let me tell you that it is *water* which causes the dimness, and when we shall next meet I will show you that we can make it, without difficulty, assume the form of a liquid.

Starch from Potatoes.

At Stowe, Vt., there are five factories in which starch is made from potatoes. Each consumes about 20,000 bushels per annum, and eight pounds of starch is the yield of each bushel.—*Scientific Amer.*

The Board of Arts & Manufactures
FOR UPPER CANADA.

PROCEEDINGS OF THE SUB-COMMITTEE.

Thursday, March 14th, 1861.

The Sub-Committee met at the Board-rooms, according to adjournment, at half-past 1 o'clock, p.m. Present: the President (Dr. Beatty), Vice-President (J. E. Pell, Esq.), Prof. Hind, Prof. Hincks, Dr. Craigie, W. Hay, Esq., and Mr. T. Sheldrick.

Minutes of former meeting were read and confirmed.

The Secretary read a letter from the Lower Canada Board, in relation to the *Journal*, and to the great Exhibition of 1862.

An account for books, and for printing the March number of the *Journal*, was ordered to be paid.

The Secretary reported that he had effected an insurance on the books, fixtures, and furniture of the Board, for $1000, at one per cent. premium, in the Provincial Insurance Company.

The President reported that the Board of Agriculture has appointed a special committee to cooperate with this Board in matters relating to the World's Exhibition, in 1862; and that said Board has adopted the draft of amendments to the act of incorporation, as previously agreed upon by this Board, and has appointed a special committee to cooperate with the committee appointed by this Board in procuring the passage of such amendments; and that said Board has also requested this Board to prepare the prize list for the arts and manufactures department of the next Provincial Exhibition.

The Committee appointed at the previons meeting to draft a series of suggestions in relation to the International Exhibition of 1862, presented the following

REPORT.

The Committee appointed to draft a series of suggestions relating to the steps which should be taken by the Board of Arts and Manufactures for Upper Canada to secure a comprehensive representation of Canadian industry and natural resources at the International Exhibition to be held in London during 1862, beg to report that they have endeavoured to indicate some of the objects towards which the efforts of the Board should be directed, and to suggest the manner in which they may be carried out.

It is necessary to state, at the outset, that the suggestions of this Committee are based upon the supposition, that it is the desire and intention of the government that Canada should be represented at the Exhibition of 1862, as in the former Exhibitions held in London and Paris in the years 1851 and

1855 respectively, but with such additional display as the progress of our civilization, the increased knowledge of the resources of our country, and the experience of the past, enable us to make.

The Committee do not consider it necessary to dwell upon the great advantages which the honorable position attained at former Exhibitions has been to Canada, in making the resources of the country better known in Europe, and in directing the attention of the emigrating classes to it as a desirable field for settlement or commercial enterprise. They consider themselves justified in assuming, that no one will be disposed to question the propriety of an endeavour to maintain a reputation already productive of numerous benefits, and susceptible under judicious management of directing renewed and increased attention to Canada as a field for emigration and for the employment of capital and industry.

The Committee understand it to be the desire of the Board, in thus early adopting measures to facilitate the representation of our civilization, industry and resources at the Exhibition of 1862, before the action of the government or the amount of aid available is made known, to obviate as far as possible the difficulties and disadvantages which were felt previous to former exhibitions, on account of the short notice which was given to exhibitors, that the display would partake of a provincial character, and that aid would be supplied by a public grant.

A moment's reflection will suffice to show that if an entire year is not devoted to the collection of some of our natural productions, especially those of the vegetable kingdom, the representation will be incomplete, and therefore, to a certain extent, valueless, as the season in which many necessary specimens are best developed will soon pass away. And here your Committee cannot refrain from urging on the Board the absolute necessity of a scientific arrangement of all our natural products. They are perfectly aware that very many persons do not acknowledge the necessity of this precision, but the Committee call especial attention to the fact, that the jurors of the Exhibitions of London and Paris laid the greatest stress upon scientific arrangement, and many valuable products were wholly neglected and ultimately forgotten, in consequence of the absence of this requisite. It is to be borne in mind that the jurors of the Exhibition of 1862 will be, like their predecessors in 1851 and 1855, men of the highest scientific and commercial rank, who will recognize as the basis of their awards in most displays of natural productions, scientific classification, whereby they are enabled to form a correct estimate of the value of any new material not previously known to industry or commerce, and to point out hopeful fields for speculative enterprise. The Committee might quote numerous instances of the loss which has attended an absence of this necessary guide, did they think that the subject required such amplification.*

In submitting the following outline the Committee desire it to be understood, that it is by no means to be considered as affording a complete list of Canadian natural productions or manufactures. It is intended rather to assist those whose profession or employment renders them familiar with details, in order that they may fill up the blanks; and for this purpose the Committee suggest that so much of this report as may be approved of be printed and distributed among professional men, merchants and manufacturers, with a request that they will enumerate any additional articles according to their personal knowledge, of their value or probably utility; a measure which will greatly contribute, it is thought, to the adoption of a final plan of operations, when the whole question comes before a general Committee, to be appointed in all probability by the authority and with the sanction of the government.

It is customary, in classifying the various industries of Canada, to group them under the following headings:

1. Agricultural Productions.
2. Productions of the Forest.
3. " of the Mine.
4. " of the Fisheries.
5. " of Animals.
6. Manufactures.

I.—Agricultural Productions.

Whatever relates to the agricultural productions of Canada, the Committee are persuaded will be most ably served by the Board of Agriculture, who have appointed a Committee to co-operate with this Board, and who will give especial attention to this department.

II.—Productions of the Forest.

1. Timber.
2. Gums and Resins.
3. Oils.
4. Dye Stuffs.
5. Tanning Materials.
6. Potashes.
7. Miscellaneous.

Among the most important results of the Exhibitions of 1851 and 1855, was the acquisition of correct ideas respecting the state of our knowledge of forest productions in their relation to manufacturing industry. It has been well said by one of the Jurors of the Exhibition of 1851, that, "even a slight examination of the raw produce which forms the basis of our manufactures, must lead to the conclusion that in many cases the best substances are not used, nor are the best modes of preparing them

* The Committee take occasion to refer to the articles published in the March number of the Journal of the Board. entitled, "Canada at the International Exhibition of 1862" and "European Emigration to Canada," in which some of the advantages of Scientific arrangement at the Exhibitions of 1851 and 1855 are pointed out.

followed." "A new substance, like a new process, is looked on with distrust;" "it is not in the market; the broker does not know it—and that is nearly the same as pronouncing it of no value."

I.—TIMBER.

A full representation of the woods of Canada involves the necessity of a collection, scientifically arranged, of all the most important trees of our forests, embracing a portion of the trunk, specimens of the leaves, bark, flowers, fruit, and portions of the roots of many species.

Each tree should be represented by—

1. A part of the trunk in its natural state, three feet long.
2. A block, when procurable, at least one foot cube, planed and polished on all sides.
3. Specimens properly preserved of the bark, leaves, fruit and flower.
4. Sections of the butt-end and roots of certain trees, distinguished by their *feather*, or grain.

Subjoined is a list of Canadian forest trees used in the arts and manufactures, of all of which specimens of the parts named in the foregoing paragraphs should be procured. The locality in which each species is most abundant, and the area of its distribution, should be determined and stated. It is advisable that all contributions should be sent in the rough state to one central locality, where they may be submitted to a uniform mode of preparation for Exhibition.

LIST OF THE MOST IMPORTANT CANADIAN FOREST TREES.

1. *Magnoliaceæ.*

White wood, so called in Canada (*Liriodendron tulipifera.* Linn.) Common in Western counties.

2. *Tileaceæ.*

Lime, or Bass-wood (*Tilia Americana.* Linn.)

3. *Anacardiaceæ.*

Sumach (*Rhus typhina.* Linn.)

4. *Aceraceæ.*

Maple (*Acer Saccharinum.* Linn.) Common.
Waved Maple " "
Bird's Eye Maple " "
Red Maple. (*Acer rubrum.* Linn.)
Soft Maple (*Acer Dasycarpum.* Ehrhart.)

5. *Amygdalaceæ.*

Wild Yellow Plum (*Prunus Americana.* Marshall.)
Red Cherry (*Cerasus Pennsylvanica.* Loisel.)
Black Cherry (*Cerasus serotina.* De Candolle.)
Choke Cherry (*Cerasus Virginiana.* De Candolle.)

6. *Cornaceæ.*

Cornel, flowering dogwood (*Cornus Florida.* Linn.)

7. *Pomaceæ.*

Dotted or Apple Thorn (*Cratægus punctata.* Jacquin.)
Red Thorn (*Cratægus coccinea.* Linn.)
White Thorn (*Cratægus crus Galli.* Linn.)
Mountain Ash (*Pyrus Americana.* De Candolle.)
June or Service berry (*Amelanchier Canadensis.* Torrey & Grey.)

8. *Fraxinaceæ.*

White Ash (*Fraxinus Americana.* Linn.) Common throughout Canada.
Swamp or Black Ash (*Fraxinus sambucifolia.* Lambert.) Common.
Red Ash (*Fraxinus pubescens.* Walter.) Sparsely distributed.
Rim Ash (*Fraxinus juglandifolia.* Lambert.)

9. *Lauraceæ.*

Sassafras (*Sassafras officinale.* Von Esenbeck.)

10. *Ulmaceæ.*

White or Swamp Elm (*Ulmus Americana.* Linn.) Common everywhere.
Red or Slippery Elm (*Ulmus fulva.* Michaux.)
Rock Elm (*Ulmus racemosa.* Thomas.) Rare.
Gray, or Winged Elm (*Ulmus alata.* Michaux.)

11. *Juglandaceæ.*

Butternut (*Juglans cinerea.* Linn.) Western Canada.
Black Walnut (*Juglans nigra.* Linn.) Western Counties.
Soft Walnut.
Shell bark Hickory (*Carya alba.* Nuttal.) Common west of Hamilton.
Smooth bark Hickory (*Carya tormentosa.* Nuttal.)
Pignut (*Carya glabra.* Torrey.)
Bitternut (*Carya amara.* Nuttal.)

12. *Corylaceæ.*

White Oak (*Quercus alba.* Linn.) Common in the western part of the Province.
Swamp White Oak (*Quercus bicolor.* Wild.)
Red Oak (*Quercus rubra.* Linn.) Common.
Black Oak (*Quercus nigra.* Linn.)
Chesnut (*Castanea vesca.* Linn.) Common in Western Canada.
Red Beech (*Fagus Ferruginea.* Aiton.) Abundant.
White Beech (*Fagus Sylvatica.* Willd.)
Blue Beech, Horn-Beam (*Carpinus Americana.* Michaux.)
Iron Wood (*Ostrya Virginica.* Willd.) Generally distributed.

13. *Betulaceæ.*

Paper or Canoe Birch (*Betula papyracea.* Aiton.)
Yellow Birch (*Betula excelsa.* Aiton.)
Cherry Birch (*Betula lenta.* Linn.)
Black Birch (*Betula nigra.* Linn.) Common.
Alder (*Alnus Incana.* Willd.)

14. *Saliaceæ.*

Black Willow (*Salix nigra.* Marshall.)
Aspen Poplar (*Populus tremuloides.* Michaux.)
Large-toothed Aspen (*Populus grandidendata.* Michaux.)
Balm of Gilead (*Populus balsamifera.* Linn.)
Cotton Wood, Necklace Poplar (*Populus monilifera.* Aiton.)

15. *Platanaceæ.*

Button Wood, American Sycamore (*Plantanus Occidentalis.* Linn.) Western counties.

16. *Pinaceæ.*

Pitch Pine (*Pinus rigida.* Miller.)
Red Pine (*Pinus resinosa.* Aiton.)
Yellow Pine (*Pinus mitis.* Michaux.)
White or Weymouth Pine (*Pinus strobus.* Linn.) Common in the northern part of the Province.
Balsam Fir (*Abies balsamea.* Marshall.) Common in the North.

Hemlock Spruce (*Abies Canadensis.* Michaux.) Common.
White Spruce (*Abies alba.* Michaux.) Common in Northern parts.
Black Spruce (*Abies nigra.* Poiret.) Common in Northern parts.
American Larch, Tamarack (*Larix Americana.* Michaux.) Common in swamps.
White Cedar (*Thuya Occidentalis.* Linn.) Common in swamps.
Red Cedar, Savin (*Juniperus Virginiana.* Linn.)

The following comparative table shows the value of the Exports alone of the Productions of the Canadian Forests during the years 1857, 1858 and 1859:

	1857.	1858.	1859.
Ashes—Pot	$859,863	$740,933	$769,512
Pearl	287,993	188,826	337,759
Timber—Ash	25,360	16,999	24,067
Birch	46,985	30,339	56,294
Elm	432,822	163,389	200,840
Maple	1,593	285	723
Oak	576,630	377,561	359,731
White Pine	2,821,320	1,811,340	2,249,006
Red Pine	526,458	374,079	363,567
Tamarack	28,471	5,410	11,382
Walnut	51,140	22,837	25,719
Basswood, Butternut and Hickory	15,462	20,121	14,800
Standard Staves	548,384	398,874	329,876
Other Staves	174,771	170,379	201,047
Battens	4,276	897	1,962
Knees	466	3,470	4,723
Scantling	22,168	22,922	23,760
Treenails	140	202	300
Deals	1,955,377	1,675,918	1,477,381
Deal Ends	58,852	36,115	44,526
Planks and Boards	2,573,470	2,902,267	2,690,119
Spars	84,410	32,319	25,383
Masts	135,884	69,617	92,714
Handspikes	437	713	1,569
Lath and Lathwood	60,825	34,230	37,216
Firewood	62,558	36,155	42,187
Shingles	46,257	24,314	36,157
Sleepers	1,363	....	....
Railroad Ties	18,025	39,524	23,861
Oars	6,582	11,405	17,188
Other Woods	35,726	25,367	75,098
Saw Logs	111,440	47,734	125,490
Total Produce of the Forest	$1,1575,508	$9,284,514	$9,663,962

REMARKS.

1. *Acer saccharinum* (Sugar Maple). This tree is common throughout Canada, and very large quantities of sugar are made from it annually. It is important to bear in mind that while the sugar maple is most recklessly destroyed in the process of clearing land in every part of Canada, the French government are fostering the cultivation of this tree in France, with a view to the production of sugar from it. The bird's-eye maple, a variety of the sugar maple, is esteemed one of the most valuable woods in Europe for cabinet work, and would always command a high price in that market.

2. *Tilia Americana* (Basswood). The inner bark of this tree is valuable for its fibre; it may be manufactured into cordage, and it is one of those numerous fibres which have been recommended and employed for the manufacture of paper.

3. *Carpinus Americana* (Blue Beech). The wood of this tree is much sought after for the manufacture of cog wheels and other parts of machinery, where great toughness is required.

4. *Juglans cinerea* (Butternut). The bark of this tree contains a dye.

5. *Abies Canadensis* (Hemlock). The bark is very extensively used in tanning.

6. *Carya alba* (Hickory). The bark contains a yellow dye.

7. *Sassafras officinale* (Sassafras). Valuable for the essential oil contained in the root.

8. *Abies balsamea.* Large quantities of Canada balsam are obtained from this tree.

9. *Rhus typhina* (Sumach). The young shoots and flowers only of this dye plant are valuable. It is stated that the reason why the American sumach does not enjoy the same reputation as the *Rhus coriaria* of Europe, arises from the fact that the old shoots are used. The shoots of the year should be taken before the leaves fall, and dried quickly in the sun.

II.—GUMS AND RESINS.

1. Canada Balsam.
2. Turpentine.
3. Pitch.
4. Spruce Gum.

III.—OILS.

Oil of Cedar.
Oil of Spruce.
Oil of Hemlock.
Oil of Birch (distilled from the bark).

[This oil is of great interest. It is used in the manufacture of Russian leather, from which that material derives its odour, and its power of resisting the attacks of insects. It is particularly desirable that this product should be represented, with specimens of leather prepared by it.]

Oil of Linseed.
Oil of Mustard.

Specimens of the Wood, Bark, Seeds, &c., from which the Oil is procured, should accompany each contribution.

IV.—DYE-STUFFS.

It should be remarked at the outset that Dye-stuffs should always be placed side by side with samples of the Colour they yield, and in every case where practicable the use of each substance should be illustrated. Professor Edward Solly, in his lectures on the result of the Exhibition of 1851, says: "When we remember how many thousand tons of dyeing-woods are annually imported, and how many thousand tons are absolutely useless woody fibre, we cannot help coming to the conclusion that here chemical science might be applied with great advantage, and that if colonists could be taught how to extract and concentrate the true colouring principles of these woods, much unprofitable labour and expense would be saved; nay, more, these concentrated dye-stuffs might be profitably imported from places from which the cost of carriage would altogether prevent the importation of the dye-stuff

in its raw state. This is a matter of great practical importance, and one which has not yet received the attention it deserves." That our woods furnish some excellent natural dyes, all will admit, who have seen the brilliant colours produced by the simple arts of the native Indians.

The following are some of the native Canadian dyes:

Alder, the bark.
Sumach, the bark and flowers.
Blood Root, the flowers and root.
Butternut, the bark.
Hickory, the bark.
Golden Rod, flowers.

V.—TANNING MATERIALS.

Hemlock, bark.
White Oak, bark.
Sumach, leaves and bark.

MISCELLANEOUS.

Labrador Tea Plant (*Ledum Latifolum*). Common in swamps on the north shores of Lakes Huron and Superior. At least two bushels of this plant should be collected.

Wild Hemp (*Canabis sativa*), in the natural state, made into cordage, and bleached.

Asclepias (Milkweed). Two or three species, with the fibre prepared and bleached, and specimens of the Silk.

A series of Specimens, illustrating the vegetables from which various pharmaceutical products are obtained, with the product as fitted for the market.

Wild Rice (*Zizania aquatica*). This is an important plant, little known in Europe. It should be represented by specimens of the entire plant, and several quarts of the ripe grain.

Slippery Elm Bark (*Ulmus Fulva*). A valuable medicinal product.

Blitum (Strawberry Blite). A red dye.

Preserved and Manufactured Articles of Food.

III.—Productions of the Mine.

The following quotation from the Reports of the Jurors is sufficient to show that the representation of the Mineral wealth of Canada cannot be placed under better management than that of the distinguished head of the Geological Survey, Sir W. E. Logan:

"Of all the British colonies, Canada is that whose exhibition is the most interesting and complete; and one may even say that it is superior, so far as the mineral kingdom is concerned, to all countries that have forwarded their productions to the Exhibition. This comes from the fact that the collection has been made in a systematic manner; and the result is, that the study of it furnishes the means of appreciating at once the geological structure and the mineral resources of Canada. It is to Mr. Logan, one of the members of the Jury, who fills the office of Geological Surveyor of Canada, that we are indebted for this collection; and its value arises from the fact that he has selected on the spot most of the specimens that have been sent to the Exhibition, and arranged them since their arrival in London."

It will probably be advantageous to describe briefly the manner in which the productions of the mine were represented in 1851. Useful hints may be gleaned from that arrangement by intending exhibitors:

The arrangement adopted was similar to that given in the Catalogue of Canadian Economic Minerals, appended to the Report of 1849-50. It was purely technical, and the collection was divided into ten classes:—

1. Metals and their ores.
2. Minerals requiring more complicated chemical treatment to fit them for use.
3. Mineral paints.
4. Materials applicable to the fine arts.
5. Materials applicable to jewellery.
6. Materials for glass-making.
7. Refractory materials.
8. Grinding and polishing materials.
9. Materials applicable to the purposes of common and decorative construction.
10.—Miscellaneous materials.

Thus classified the specimens were placed in regular sequence in the space allotted them, and each kind from each individual source was accompanied by a ticket which gave the name of the material, the quantity in which it occurred, the geological formation and the locality in which it was situated, with the facilities for working it, and the name of the exhibitor.

It is important to notice that all materials applicable to the purposes of common and decorative construction, should be represented by dressed blocks, in their application to useful or ornamental purposes.

Attention is especially called to the representation of Petroleum. The occurrence of this material in large quantities in different parts of Canada, and the advantages it promises as a new source of industry, make it very desirable to secure an ample representation in its raw and manufactured state.

IV.—Animal Productions.

1. Glue.
2. Isinglass, from the Sturgeon.
3. Neat's foot Oil.
4. Bees' Wax.
5. Lard Oil.
6. Moose, Cariboo, Bear, &c., Skin.
7. Furs.
8. Porpoise Leather.
9. Whale Leather.
10. Sealskin Leather.

V.—Productions of the Fisheries.

The fisheries of the Gulf and Lower St. Lawrence as well as of the Inland Lakes, are among the great natural resources of Canada.

The total produce of the fisheries exported during the years 1857, 1858, and 1859, were respectively, \$540,113, \$718,296, and \$817,423, but the value of the fish taken in the Gulf and Lower St. Lawrence

in 1859 exceeded one million dollars, giving employment to about 6000 men. The annual exportation of fish oil has risen from $19,000 in 1855 to $30,000 in 1859. These figures represent the value of exports of fish oil from three ports in the Gulf and Lower St. Lawrence. As the produce of the fisheries are chiefly exported or brought into the market in their raw or unmanufactured state, it is scarcely necessary to dwell upon this branch of industry, as it does not admit of representation by specimens. Among the products which have already acquired importance or give promise of becoming so, are:

1. Seal oil.
2. Cod liver oil.
3. Porpoise oil (*Delphinus Minor.*)

[This oil is particularly valuable on account of its retaining its fluidity at extremely low temperatures.]

4. Porpoise leather.
5. Whale oil.
6. Capelin oil.
7. Shark oil.
8. Fish manure.

All of the oils should be sent in the raw state and also clarified.

VI.—Manufactures.

With reference to this important department of our national industry, this committee would urge the necessity of individual exertion on the part of those who are engaged in different branches, and the great importance of a full representation of our growing manufactures, at the International Exhibition. In view of the increasing attention which Canada is now attracting in the United Kingdom, it is essentially necessary that intending emigrants should be made fully aware that they can readily and economically obtain all the necessary and most of the more advanced manufactures for private consumption, or for their employment in different kinds of industry. The remarkable cheapness of many common articles of furniture and domestic economy, make it advisable that they should be represented, with a view to show how far the facilities enjoyed in Canada, from an abundance of raw material and admirably adapted machinery, have been taken advantage of.

The classification, in detail, of articles in the Department of Manufactures, would be premature at present, but it would undoubtedly form a prominent feature in a general scheme, if it should be thought advisable to take any additional steps before the action of the Government is made known.

Always bearing in mind that the most encouraging hopes of future success are foreshadowed by a willingness to accept the lessons taught by the Exhibitions of 1851 and 1855, we do not scruple to draw attention to the teachings of competent judges, when we quote a few opinions regarding our manufactures ten years ago.

The Jurors say that "the quality of the fibre of Canadian flax and hemp is good, but its preparation faulty and objectionable; with a little more care, the value of each would be considerably increased." Since that period several Flax Mills have been established in Upper Canada, and the staple which they have produced will no doubt show the great and rapid progress which has been made in this very important branch of industry during the past ten years. The same remark may be applied to Soaps, to which reference is made in the succeeding paragraph.

Of Canadian soaps, the Jurors say "the yellow soap from Canada possesses a most disagreeable odour; the fancy soaps are likewise badly made, giving no lather whatever."

The manufacture of stearine candles was commended, and, from what was sent to the Exhibition, the Jurors infer that the art will soon be perfected.

In flannels, it was said that Canada furnished "a few common and low flannels; but not much in this line has yet been attempted here."

In the Summary of the Jurors they say: "It is not therefore to be expected that much attention can be given to Arts and Manufactures that are yet in their infancy; still the specimens sent will convey to the English artisan an idea of the field there is for the exercise of his calling. The blankets, horse-cloths, and grey *etoffe de pays*, will bear comparison with those of any other country."

It remains now to be shown how general has been the progress throughout the country since the Jurors of 1851 were called upon to express their opinions respecting our manufactures in their infancy.

The following is a general classification of Machinery and Manufactures:—

I.—MACHINERY.

1. Machines for direct use, including Carriages, Railway and Marine Mechanism.
2. Manufacturing Machines and Tools.
3. Civil Engineering, Architectural and Building Contrivances.
4. Philosophical, Musical, Horological, and Surgical Instruments.

II.—MANUFACTURES.

1. Woollen and Worsted.
2. Flax, Hemp and Cotton.
3. Leather, Saddlery, Boots and Shoes.
4. Skins and Hair.
5. Paper, Printing and Bookbinding.
6. Woven, Felted, and Laid Fabrics.
7. Dyed and Printed Goods.
8. Carpets, Oil Cloths, &c.
9. Articles of Clothing.
10. Cutlery, Edge and Hand Tools.
11. General Hardware.
12. Gold and Silversmith's Work.
13. Furniture, Upholstery, &c.
14. Manufactures in Mineral substances, for Building or Decoration.

15. Manufactures from Animal and Vegetable substances, not woven or felted.
16. Miscellaneous Manufactures and Small Wares.

The committee do not feel themselves in a position to make any further suggestions respecting details; future steps will probably be entirely dependant upon the aid which may be available from a public grant. It is of the utmost importance that this question should be disposed of at an early date, in order that active steps may be immediately taken.

W. Hay, *Chairman.*
Henry Y. Hind,
William Hincks,
J. E. Pell.

Resolved, That the report of the Committee on International Exhibition, be received and adopted, and printed in the *Journal* of the Board; and that the Secretary be instructed to transmit copies of the Report to the Board of Arts and Manufactures for Lower Canada, and to the Board of Agriculture for Upper Canada; and that five hundred copies be printed in a supplement to the *Journal* and distributed to the various manufacturers and others throughout the Province.

Resolved, That the Committee on the International Exhibition be re-appointed, with instructions to cooperate with any committee that may be appointed by the Lower Canada Board of Arts and Manufactures, and with the committee already appointed by the Board of Agriculture for Upper Canada, in carrying out such preliminary arrangements as may be found necessary.

Resolved, That the President, Vice-President, and Secretary, be a Committee to prepare a prize list for the next Provincial Exhibition, in connection with the Committee named on behalf of the Board of Agriculture.

Resolved, That the Committee on Act of Incorporation be instructed to co-operate as far as possible with the Board of Agriculture for Upper Canada, and with the Board of Arts and Manufactures for Lower Canada, in procuring the necessary amendments thereto.

The meeting then adjourned.

W. Edwards, *Secretary.*

THE ACT RELATING TO BOARDS OF ARTS AND MANUFACTURES.

Subjoined is the portion of chapter 32 of the Consolidated Statutes of Canada, which relates to this Board, and to the Annual Exhibitions of Agricultural, Horticultural, Arts and Manufactures Products, with such amendments incorporated therein as were agreed upon during last year by the Boards of Arts and Manufactures for Upper and Lower Canada, and, with two or three trifling exceptions, by the Board of Agriculture for Upper Canada. The Board are now applying to the Government and Legislature for the adoption of these amendments.

We regret not yet having received the Minutes of Proceedings of the Board of Arts and Manufactures for Lower Canada in relation to any further amendments proposed, but we believe that amongst others it is now the intention of that Board to ask for a total separation from the Board of Agriculture, in relation to Exhibition matters. On this point the Upper Canada Board differ widely from their brethren of Lower Canada, believing it to be far more to the interest of all classes in Upper Canada that the connexion should be maintained, and they have therefore, in the amended Bill now proposed, made provision for a joint and harmonious working with the Board of Agriculture.

Members and Officers.

I.—There shall be, in and for Upper Canada, a Corporation, composed as hereinafter provided, and called "The Board of Arts and Manufactures for Upper Canada."

II.—There shall be, in and for Lower Canada, a Corporation, composed as hereinafter provided, and called "The Board of Arts and Manufactures for Lower Canada."

III.—Each of the said Corporations may acquire and hold real or immoveable property for the purposes of the Corporation, and may sell, exchange, lease, or therwise dispose of or depart with the same from time to time; but no property shall be sold or otherwise alienated unless by authority of the Board, granted for that purpose, at a meeting held after special notice shall have been given of the business to be transacted, and by a vote of at least two-thirds of the members present at such meeting.

IV.—The said Corporations shall respectively be composed of the Minister of Agriculture for the time being (who shall be *ex officio* a member of each); the Professors and Lecturers in the various branches of Physical Science in the Chartered Universities and Colleges affiliated with Universities in Upper and Lower Canada respectively; the Chief Superintendents of Education in Upper and Lower Canada respectively, for the time being, *ex officio;* the principal or staff officers of the Provincial or Geological Survey in that section of the Province in which they may be respectively residents; the Presidents for the time being of, and one delegate from each of the incorporated Boards of Trade; and the President of, and delegates from each incorporated Mechanics' Institute, or of any incorporated Arts Association, qualified as hereinafter mentioned, in Upper and Lower Canada respectively—such delegates to be chosen annually as hereinafter provided; and the Faculty of any institution of learning, of Collegiate rank, composed of at least five Professors or Lecturers—one of whom shall be a professor or lecturer upon Physical Science,—may, in the month of December in each

year, elect one of such professors or lecturers to represent such College or Faculty upon such Board, and the President or Principal of such College or Faculty shall certify to the Board the name of the Professor or Lecturer so appointed.

V.—The incorporated Boards of Trade in each City and Town in Upper and Lower Canada respectively, shall at its last meeting in each year, elect and accredit to the Board of Arts and Manufactures for Upper or Lower Canada, (according as its place of meeting is in Upper or Lower Canada) one of its body as a member thereof.

VI.—Each incorporated Mechanics' Institute in Upper or Lower Canada respectively, shall, at its last meeting in each year, elect and accredit to the Board of Arts and Manufactures in Upper or Lower Canada, one delegate for every twenty members on its roll, being actual working mechanics or manufacturers, and paying an annual subscription of at least one dollar each to its funds.

2. Each incorporated Arts Association in Upper or Lower Canada respectively, expending not less than one half of its annual income in the promotion of the Fine or Industrial Arts in Canada, shall, at its last meeting in each year, elect and accredit to the Board of Arts and Manufactures in Upper or Lower Canada, one delegate for every thirty members on its roll, who are paying an annual subscription of at least two dollars each to its funds.

3. But no Institution or Association shall be entitled to send more than fifteen delegates to either of the said Boards ; and in case a vacancy occurs in the representation of any Mechanics' Institute, Board of Trade, or Arts Association, entitled to send delegates to either of the said Boards, such Institute, Board, or Association may, at its first meeting thereafter, elect a delegate or delegates to fill such vacancy.

VII.—The names of the delegates elected, together with the names of the Presidents of such Mechanics' Institutes, Boards of Trade and Arts Associations, as aforesaid, shall be forthwith transmitted by the Secretary of the Institute, Board or Association electing them to the Secretary of the Board to which they are elected, who shall thereupon inscribe their names upon the roll of the members of the said Board, for the year about to commence.

2. With the names of the delegates when transmitted by the Secretary of a Mechanics' Institute or Arts Association, there shall be transmitted a statement, under the corporate seal of such Institute or Association, and verified by the written declaration of the Secretary transmitting the same, of the names of all the members on the roll of such Mechanics' Institute who are working mechanics or manufacturers, and are paying an annual subscription of at least one dollar each to the funds of such Institute ; and the names of all the members on the roll of each Arts Association, who are paying an annual subscription of at least two dollars each to the funds of such Association.

3. If it appears by the said statement that any Mechanics' Institute or Arts Association has elected too many delegates, then the Secretary of the Board shall abstain from recording any of the names of the delegates of such Institute or Association, and shall submit the matter to the Board at its first meeting ; and the said Board may, if they see fit, adjudge that such Mechanics' Institute or Arts Association shall not be entitled to any delegate for the year then next ensuing, or may decide by vote or ballot which delegate or delegates shall be rejected, and in this latter case the names of the remaining delegate or delegates shall be forthwith inscribed on the roll of members.

4. The wilful making of any false statement or declaration required or authorised by this Act shall be a misdemeanor, punishable by fine, in the discretion of the Court.

Meetings and Functions of the Board.

VIII.—The said Boards of Arts and Manufactures shall meet at the Cities of Toronto and Montreal respectively, twice in every year, that is to say, on the last Tuesday in the month of January and July, if such Tuesday be not a holiday, but if it be a holiday the meeting shall take place the next day thereafter, not being a holiday.

2. And the President of either of the said Boards, and in his absence from the Province, or in the case of a vacancy in the office of President, then the Vice-President, whenever he deems it necessary or is required by any ten members thereof so to do, shall call a special meeting of the same, in the interval between any two meetings.

3. But no such special meeting shall take place until seven clear days after a written or printed notice signed by the Secretary of the Board, and specifying the day, hour and place of meeting, and the object or objects for which the same is called, has been mailed to the address of each member of the Board.

IX.—Each of the said Boards shall, at its regular meeting in January in each year, elect from among its members a President, Vice-President, and a Secretary and Treasurer, to hold office for the ensuing year, or until the election of their successors ; and shall also elect a Council of not less than five nor more than nine of their number for the management during the year, of such affairs of the Board as may by any by-law be entrusted to them.

2. The President and Vice-President shall be *ex officio* members of such Council, and the Secretary and Treasurer shall be *ex-officio* a member of such Council, when elected or appointed from among the members of the Board, and not receiving any salary

for such services; and a majority of the members of such council shall be a quorum for the transaction of business.

3. But the said Boards, or either of them, may at any time they shall see fit so to do by a by-law for that purpose, appoint some fit and proper person whether a member of such Board or not, to be the Secretary of said Board, at such salary and upon such terms as to the said Boards, or either of them may seem proper, and may remove such Secretary from time to time, and may appoint another in his stead and place; and the said Boards or either of them, may in their discretion require the said Secretary, so to be appointed as aforesaid, to discharge the duties of Treasurer for the said Board, in addition to the duties pertaining to the office of Secretary.

4. In case of a vacancy occurring in any of the said offices in the course of the year, either by death, resignation or otherwise, such vacancy shall be filled up by election as aforesaid at any regular meeting of the Board, or, in the interval, by the Council at any regular meeting thereof.

X.—It shall be the duty of the said Boards of Arts and Manufactures:—

1. To take measures, with the approbation of the Minister of Agriculture, to collect and establish at Toronto and Montreal respectively, for the instruction of practical mechanics and artizans, Museums of Minerals, and Material substances, and Chemical compositions, susceptible of being used in Arts and Manufactures, with Model rooms, appropriately stocked and supplied with models of works of art, and of implements and machines other than implements of husbandry and machines adapted to facilitate agricultural operations; and also free Libraries of Referenee containing Books, Plans and Drawings, selected with a view to the imparting of useful information in connection with Arts and Manufactures.

2. To take measures to obtain from other countries new or improved implements and machines; (not being implements of husbandry or machines specially adapted to facilitate agricultural operations) to test the quality, value and usefulness of such implements and machines.

3. And generally to adopt every means in their power to promote improvement in the Arts and Manufactures of the Province.

XI.—The said Boards, with the consent and approbation of the Minister of Agriculture, may establish in connexion with their respective Museums, Model Rooms and Libraries, Schools of Design on the most approved plan, and furnished and supplied in the most complete and appropriate manner that the funds at their disposal will admit of, regard being had to the claims thereon of the other objects for which they are hereby established.

2. And the Minister of Agriculture may cause duplicates or copies of models, plans, specimens, and drawings, and specifications, deposited in the Patent office, and upon which Patents of Invention have been issued, to be made from time to time, and placed in the Model Rooms, Museums or Libraries of the said Boards ot Arts respectively.

3. The said Boards may also found Schools or Colleges for mechanics and artizans, and may employ competent persons to deliver Lectures on subjects nocnected with the Arts and Sciences, or with Manu factures, in such manner and place as the said Boards may from time to time direct.

XII.—The said Boards shall keep records of their respective transactions, and shall from time to time publish in such manner and form as to secure the widest circulation among the Mechanics' Institutes, and among mechanics, artizans, and manufacturers generally, all such Reports, Essays, Lectures and other literary compositions conveying useful information as the said Boards are respectively able to procure.

XIII.—The said Boards respectively may make and ordain such By-laws, Rules, Orders and Regulations, not being contrary to this Act or to the laws of the Province, as they may deem necessary, touching the disposition and management of their funds, property and affairs; the holding and management of exhibitions of Works of Art and Manufactures, and the execution of the duties and powers entrusted to them by this Act; and from time to time may repeal or alter the same and make others in their stead.

2. Copies of all By-laws, Rules, Orders and Regulations, and of the minutes of the proceedings of the said Boards, shall be transmitted forthwith after they are respectively made to the Bureau of Agriculture.

XIV.—All Mechanics' Institutes and Arts Associations receiving grants of money from the Government, shall be placed under the general supervision of the Boards of Arts and Manufactures for Upper and Lower Canada respectively, in like manner as the County Agricultural Societies are placed under the supervision of the Boards of Agriculture; and the said Boards shall receive from the Government, and pay over to the respective Mechanics' Institutes and Arts Associations any grant of money to which they may be entitled.

2. And it shall be lawful for each Board to retain for the use of its periodical Exhibitions, one tenth part of all such grants; and no Mechanics' Institute or Arts Association in Upper or Lower Canada shall be entitled to receive any grant of money from the Government, unless such Institute or Association has become incorporated under the general "Act respecting Library Associations and Mechanics' Institutes," chapter 72 of the Consolidated Statutes of Canada,

or by a special Act of Incorporation; nor unless such Institute or Association shall have transmitted to the respective Boards of Arts and Manufactures for Upper or Lower Canada, a properly certified copy of its Annual Report for the past year.

3. And it shall be the duty of the respective Boards of Arts and Manufactures to send Agents to visit each incorporated Mechanics' Institute and Arts Association in Upper Canada respectively, whose duty it shall be to ascertain and report on the progress each Institute or Association is making in carrying out the objects for which the grants from the Government are made; and no Association or Institute shall be called a Mechanics' Institute within the meaning and provisions of this Act, unless it shall have at least twenty members enrolled as working mechanics or manufacturers, who are paying a subscription of at least one dollar each per annum to its funds.

Provincial Exhibition Associations.

I.—The Members of the Boards of Agriculture and of the Boards of Arts and Manufactures; the Presidents and Vice Presidents of all lawfully organized County Agricultural Societies, and of all Horticultural Societies, Incorporated Mechanics' Institutes and Arts Associations, and all subscribers of one dollar annually, shall, in their respective sections of the Province, be, and constitute a "Provincial Exhibition Association" for that section.

II.—The Members of the Board of Agriculture and the Council of the Board of Arts and Manufactures, and the Presidents and Vice Presidents of County Societies, Mechanics' Institutes, Arts Associations and Horticultural Societies, (or any two members whom a County Society, Mechanics' Institute, Arts Association or Horticultural Society may appoint instead of its President and Vice President) shall be the Directors of such Provincial Exhibition Association.

III.—The Association for Upper Canada shall hold an Annual Fair or Exhibition open to competitors from any part of the Province.

2. The Association for Lower Canada shall hold a Fair or Exhibition Annually or Bi-ennially, reckoning from the date of its last Fair or Exhibition, as the Board of Directors of the Association for Lower Canada deems best.

3. The Directors shall hold a Meeting during the week of the Exhibition, and shall at such meeting elect a President and two Vice Presidents, and shall also elect a Treasurer, who shall be paid a reasonable salary for his services; and shall appoint the place for holding the next Meeting and Exhibition of the Association, and may appoint a local Committee of Management at the place where such Exhibition is appointed to be held.

4. And the said Boards of Directors respectively, may make such rules and regulations, not being contrary to the laws of the Province, as may be deemed necessary to prescribe the powers and duties of such local committees, and for the proper management of such exhibitions; and for the disposition and management of their funds, property and affairs, and the execution of the duties and powers entrusted to them by this act; and the same from time to time to repeal or alter and make others in their stead.

5. But no repeal or alteration shall be made in any rule or regulation, unless one month's notice of such proposed repeal or alteration shall have been given in any Journals that may at the time be published by the respective Boards of Agriculture, and Boards of Arts and Manufactures.

IV.—The Board of Agriculture, and the President and Vice President of the Board of Arts and Manufactures, and three other members of the Council of said Board, to be elected annually by said Council, shall be the Council of the Association, with full power to act for and on behalf of the Association between the annual meetings thereof; and all grants of money, subscriptions, or other funds made or appropriated to, or for the use of the Association, (except money collected by or granted to any local committee for the local expenses of an Exhibition,) shall be received by and expended under the direction of the said Council.

2. And the President of the Board of Agriculture, and the President of the Board of Arts and Manufactures, shall be respectively *ex-officio* President and Vice President of the Council of the Association, and the Secretary of the Board of Agriculture, together with the Secretary of the Board of Arts and Manufactures, shall be *ex-officio* joint Secretaries of the Council and of the Association.

V.—All contracts and all legal proceedings, by, with, or concerning the Association, shall be made and had with the Council of the Association in its corporate capacity, and no other contracts, agreements, actions or proceedings shall bind or affect the Association.

Members of Mechanics' Institutes, and of other public bodies, subscribing for this Journal through their respective Societies, will have their copies addressed to them direct from the office of the Board.

The Free Library of Reference, and Model Rooms, are open to the public daily, from 10 a.m. till noon, and from 1 to 4 o'clock, p.m., at the Board Room, No. 79 King Street West, Toronto.

The Secretary of the Board acknowledges the receipt by late Mails, of extensive Catalogues of Books in

every department of Literature, from the following Booksellers and Publishers, namely:—

John Weale, H. G. Bohn, Samuel Palmer and Willis & Sotheran, of London, England; and Harper and Brother, D. Appleton & Co., and Ticknor & Fields, of the United States; and of the Department of Public Institution for Upper Canada; also Catalogues of the Libraries of the Science and Art Department of the South Kensington Museum, and of the Great Seal Patent Office; also Putnam's Bookbuyer's Manual, and the London Catalogue of Books from 1831 to 1855.

These Catalogues are available for reference to Mechanics' Institutes and Library Associations, and to the Public generally.

The regular meetings of the Sub-Committee of the Board are held on the last Thursday of each month.

The arrangements in contemplation at the date of our last issue, with the Board of Arts and Manufactures for Lower Canada, in regard to a joint interest in this journal, being now completed, subscriptions will hereafter be received by that Board, at the Board Room, Mechanics' Hall, Montreal.

The Board of Arts & Manufactures

FOR LOWER CANADA.

ANNUAL COURSE OF FREE LECTURES.

MR. PRINCIPAL DAWSON'S OPENING LECTURE.*

(Montreal, Tuesday, February 19th.)

The learned Principal opened his remarks by saying the first of the arts was the art of obtaining subsistence. Whether men were savage hunters, members of nomadic tribes or settled agriculturalists, in every case the primary object of their labour and art was to procure food. The mechanic and chemical arts followed, marking a farther stage of civilization, and the ornamental arts which came to grace and adorn our life. Of the three forms of primitive life he had enumerated the agricultural was most favorable to the development of the other arts, sinceit needed tools and appliances for its work, supplied a sufficiency of food for the artisan and conduced to a settled mode of life. Thus agriculture stimulated the arts and the arts reacted upon agriculture causing increased production of supplies of food. We judged of nations which had passed away by the remains handed down to us, marking their advancement in the arts. Their massive structures, their convenient implements, their tasteful designs, all showed the progress they had made, and they were given credit for the civilization these indicated. Invention springs originally from the necessities of men, for the creation of the means of procuring subsistence but improvement and progress toward perfect art depend on other causes. There was a marked resemblance between the earlier works of rudimentary art, all the world over. The pottery, weapons, &c., made in Britain before the Roman conquest and in other countries of Europe when compared with that made by the Indians of America shewed a striking resemblance. They were almost exactly alike. This spoke no doubt of a common origin, but also of common wants, and similar modes of supplying them. The nations most distinguished in initiating inventions on which the arts of life were based were not always the greatest in carrying them to perfection. Many stopped short, and others took up the ideas they had originated and carried them onward. For it required not alone mere invention and manual dexterity—the training of the handicraftsmen, but trained thought, scientific processes of investigations to secure continued progress. When art was left without the aid of science it ceased to make progress. Long before gunpowder or the art of printing was known in Europe, the Chinese were firing their squibs and fireworks, and printed after a fashion a newspaper in Pekin. But while Europe had wrought wonders by means of gunpowder and printing since they had been known to the European nations, the Chinese made very little better use of their inventions now than they did while Europe was sunk in barbarism. So a species of alphabet was known thousands of years ago in Egypt, but it was reserved for the Phœnicians, the Hebrews, the Greeks and the latter European nations to bring the use of writing to the perfection it has attained. The existence of steam and its possession of power, and the properties of electricity were known long before any practical use was found for them. This has only been evolved by means of scientific processes of thought. The Greeks and Romans advanced as far as we in the fine arts, but not in the useful. The reason was obvious; among them occupation in the useful arts was regarded as servile and degrading. Therefore cultivated minds did not apply themselves to their development. To make real progress in the arts of life then we must have scientific knowledge and mental training brought to aid the skilled hand. Men must be taught to penetrate, so far as may be, the designs of Providence as shewn in the material world, and discover and act upon the laws which govern it. This great fact required to be taught and much insisted on here. In some other parts of the world there was less need to do so. Here he regretted to say that the need was great. In the old European countries the doctrine was recognized and acted upon by the Government and people, and provision made for bringing instruction in science to the aid of the artizan. They had heard much of France and the great things it had done for popular scientific education. That had become a familiar instance. He would take one less known, but not less striking. He would call their attention to a little European state without seaports, without any remarkable internal resources, surrounded by a commercially hostile population, but which has made great progress in the arts and enjoys great prosperity. He alluded to the little kingdom of Saxony, and would quote from Barnard's journal of education to show what that little state had done to promote popular scientific education. The learned principal here read a list of the various schools. Beside the Polytechnic school at Dresden, and the Forest school

* From the *Montreal Gazette*, revised by the author.

at Tharandt, and the great University at Leipsig, with its 85 professors and 835 students, they had six Academies of Arts and Mining with 43 teachers and 1400 pupils, in addition to the great Mining Academy at Freiberg, 11 Gymnasia equal to our colleges, 6 higher Burghes and Real schools. Three special institutions for commercial and military education, with 42 teachers and 240 pupils, 17 higher schools of Industry and art with 72 teachers and 778 pupils, 69 lower technical schools with 7000 pupils, and 24 lace-making schools with 2000 pupils, together with more than 2000 common schools, and asylums, &c. All this for a population of about two millions! Was it any wonder that the arts prospered in Saxony. There science went hand in hand with art. Without this, the country could not sustain so large a population. Belgium also is celebrated for its industrial schools, yet Dr. Playfair informs us that 100 Belgian manufactures not content with their teaching had gone to Paris to finish their education in applied science there. The attention of Britain was called to these things by the great Exhibitions of 1851 and 1855, and very much had been done in Britain to further scientific education since that time. If it were urged that although continental nations had done these things and Britain had not, yet Britain maintained its ascendancy in industrial progress, it must be answered that Britain has had greater natural advantages and has benefited by the knowledge brought her by refugees from other lands. The workshops had bred thinkers who were not always content with things as they were in politics and religion; and many continental governments had expelled these people, who had sought Britain as an asylum and contributed in a very great degree to the success of British manufactures, if, indeed they had not been the principal agents in advancing them. The greater freedom enjoyed in Britain had a tending to develop thought and skill expressed elsewhere, but that was now believed to be insufficient, and government was aiding largely individual efforts to furnish the artizan with scientific education. In our own country we had as yet almost nothing but the raw material. We had land enough and water power and material for manufacture, but many of our advantages were wasted for lack of skill to use them to the best advantage. The most expensive man to maintain—the one who required the greatest area of country to maintain him was the savage, because he knew how to make the least use of the resources which nature offered. He could obtain less from her than any others. Therefore he needed more area for his maintenance than a European Prince. The agriculture in a new country was but little better. Land was cheap and labor dear, capital and skilled labor scarce, and the largest space was occupied with the least advantage through imperfect modes of industry. And so it was with manufacturing industry. We were altogether dependent upon the experience and scientific attainments of others. If we were ever to cease to be so, it must be by having our own people taught to apply scientific principles to their methods of labor. If we are to have the Arts flourish among us this must be done. Britain for years bought the applied science of the continent with her immense capital. We have not her capital; we have not the cheap labor to be obtained in European countries, and therefore there is no country in which labor-saving methods and machines are so much required as in Canada. It is only by superior knowledge that we can hope to overcome the disadvantage of dear labor. In no other way is it possible to compete with other nations. And that brought him to the consideration of the constitution and purposes of the Boards of Arts and Manufactures. The necessary efforts to promote the requisite education could not be left altogether to individuals. It was a wonder that government had not seen to it years ago. Even yet the government seemed half ashamed of acknowledging they had begun so good a work. These Boards were not yet given an independent position, but were in some measure grafted on the older Boards of Agriculture. The act provided a great deal of work for them to do. They are to take charge of and promote periodical exhibitions of the industrial products of the country, a most useful thing as shewing strangers what the country was producing, and manufacturers the improvements in manufacture which others were making. They had to provide museums of industrial products—more useful than periodical exhibitions inasmuch as they afforded permanently at all times the like information. They were to provide free libraries of reference, in which work-people and manufacturers might be able to refer to various expensive works which individuals could not afford to have in their libraries, teaching what inventions and scientific methods had been in use in other countries. They were to provide, as far as possible, or assist in providing, education for the people employed during the day in the work-shops, and unable to attend the ordinary public schools. And they were also to furnish free lectures on subjects likely to awaken an interest in practical science, if possible to classes formed for scientific study. They were to issue publications having the same end in view; and were to affiliate with them as subordinates or assistants, the various Mechanics' Institutes which gave proof of a desire and capability to do the work with advantage. Here was a great work, a magnificient function for the Boards—and yet, he hardly desired it to go abroad, the government expected it to be all done out of munificent grant of £500 per annum, a sum not more than sufficient to secure the services of an efficient secretary and editor for a journal of their transactions. By this he would not desire by any means to imply that the present secretary was not efficient, although he had done the work so long and so zealously for nothing. He only meant that was a state of things that ought not to exist—that was hardly creditable. They could not of course do what the Act indicated as their duties, but they had attempted something. He could speak more particularly of the Lower Canada Board. Some institutes had been affiliated, until the Legislature killed the majority of them by cutting off the grants, and there were few left in Lower Canada to affiliate. Schools in connection with some of these had been tried, and one—that in connection with the Montreal Institute which had last winter 200 pupils—was a model for such schools. The Board had also procured the delivery of Lectures upon scientific subjects, and had made efforts to form classes for the systematic study of chemistry. It had, with foreign aid, been enabled to gather together a small but valuable nucleus of a library of reference. It has been unable to establish a journal of its own, but the Upper Canada Board having started one, it was proposed to join them in that work.

With regard to exhibitions they had made their first great effort on the occasion of the Prince's visit. They believed and the Government believed that

nothing more important could be done to provide a fitting welcome for the Prince, or to render his visit of benefit to the Prince, than to get together a good display of the Industrial resources of the country at one central point. It had been known long ago that furs and timber could be found in the "acres of snow" which King Louis ceded to Britain, but about our agricultural resources and mineral riches almost nothing was known until the great Exhibitions of London and Paris. What advantages we had made in manufacturing industry and the arts of life was still unknown to many. It was highly desirable that an exhibition should be got up which would inform our distinguished visitors on this point. At the season of the Prince's visit much of the farming could be seen by the traveller in passing through, but the manufactures could only be adequately judged of in such an exhibition. They thought the people everywhere would see it in that light; much to their disappointment they only partially did so. The attempt made was some years in advance of the popular ideas. The Agricultural Board had little sympathy, seeing that the management was not placed in its hands. The Upper Canada Boards, actuated by that local jealousy and pride, which was everywhere unfortunately too common, devoted themselves to an Upper Canada Exhibition. The Corporation of Montreal would not give even the ordinary grant to annual exhibitions, except upon terms which the Board could not accept; and when an appeal was made to individual citizens, to aid the great national object of showing the Prince and the distinguished men he brought with him the vast resources and the industrial progress of the country—the people of this, the great centre of the industrial and commercial activity of the country thought it a matter of a subordinate interest to a grand display of one of the arts not included in the function of the Board—the art of dancing! and a larger subscription was obtained for a ball than for the great Industrial Exhibition.

Notwithstanding all its difficulties and disappointments the Board succeeded in erecting a building which is in itself a triumph of Canadian art, and in collecting the largest exhibition of the products of Canadian manufactories and workshops ever presented to the public—an exhibition which astonished every one not very familiar with the condition of the growing arts and manufactures of the country. The building we have, still incomplete, it is true, burdened with debt, but still in such a condition as to render any subsequent exhibition a comparatively simple and inexpensive matter. Had we been aided, as we should have been by this city, we should have had something more. Our building would have been complete. It would have been open throughout this winter for lectures and other means of art education—as a museum and public library—and the artizans of this city and all who visit it on business or pleasure, would have found there a nucleus at least of those means of reference and improvement which it is the duty of this Board to provide. These ends we have not yet been able to attain, but we have taken important steps toward them, and the rest must follow, unless the Government and people of Canada are blind to the great objects to be attained by the nurture of our arts and manufactures. We aim then at the establishment of a great industrial museum, representing all the natural products and manufactured articles of Canada, and including everything that we can collect from abroad likely to guide and stimulate invention and improvement here. We desire to collect a library of reference, which shall enable any one studying, and especially in art or practical science, to avail himself of all that others have known or done. We wish to establish special schools of art and practical science similar to those in the old world to which I have already referred, and and to diffuse, both by lectures and in a printed form, all the information which can be obtained on matters applicable to the present state of our industrial pursuits. These labors are not to be confined to this city. The Board must aid and stimulate the organization of Mechanics' Institutes and industrial schools throughout the Province, and must make all its institutions centres of light and information to the whole country. To effect these objects will demand a far larger amount of public aid than we have yet received; and this we must receive if Canada is to keep itself abreast of its commercial and manufacturing rivals. Let it not be said that it is too soon to attempt such institutions as those to which I have referred—that we are in advance of the time. It is lamentable to think that public attention in Canada has not been earlier aroused to such subjects. The work is all before us; the need of it appears on every hand; it is worth doing; and all that is wanted is, that active and sustained efforts should be bestowed on it. Nor must it be said that the public money is wasted in such efforts. Nothing more surely repays expenditure in any country than wise and enlightened attention to the culture of mind as the means of acting on matter. Cultivate this and all other interests will advance.—Neglect this and national interests languish and you fall perhaps irretrievably behind your more active rivals. Canada is now just in that state of progress when enlightened public effort on behalf of its agriculture, its arts and manufactures should be a first and leading object with its statesmen, and it is through this Board and similar instrumentalities that this effort must be put forth. Let me add that though this Board is for Lower Canada, yet that being placed and appropriately, in the great centre of commerce and manufactures, it must look principally to Montreal for men and means, and that this city will find by supplying these liberally it will best consult its own interests.

PROCEEDINGS OF INSTITUTIONS.

Abstract of Proceedings of the Hamilton and Gore Mechanics' Institute.

The Annual Meeting of this Institute was held in the News Room, on Friday evening, 22nd February, 1861—the Vice-President, J. F. Rastrick, Esq., in the chair.

The Report of the Board of Directors for the year past was read by the Secretary, adopted and ordered to be printed for the use of members.

The Directors, in presenting the twenty-second Annual Report, submitted a general statement of the affairs of the Institute for the past year.

I.—The Membership.

Number of members as shewn on the register, on the 1st Feb., 1860	468
Joined since that date	115
	583

Number of members or names handed in from the M. L. Association who have never come forward	60	
Number resigned or left the city, chiefly the latter	127	
		187
		396

Decrease since last Annual Report 72.

The Members are classified as follows:—

Honorary members	13
Ordinary do	359
Junior do	24
Total	396

II.—The Finances.

Dr.

Balance from last year	$295 35
Subscriptions till 1st Feb., 1861	939 05
Hall rent	1149 38
Sale of papers	105 12
Lecture account	145 85
Sundries	213 52½
Total	$2,848 27½

Cr.

Outstanding debts 1st February, 1860, but since settled	$522 04
Whitewashing, cleaning hall, &c.	105 55½
Postage	65 09
Salaries account	450 16
Insurance	40 00
Interest	595 88
Gas	465 95
Wood and coal account	61 62½
Sundries	293 15
Balance on hand	70 50
Total	$2848 27

FINAL BALANCE OF THE BOOKS 31ST JAN., 1861.

Dr.

Cash	$70 50
Library	2,650 00
Furniture	2,612 00
Building account	20,824 31
Total	$26,156 81

Cr.

Mortgages	$11,897 44
Interest due on the same	160 00
Outstanding debts	1,979 52
Original contributions	12,119 85
Total	$26,156 81

The Board adds "in connection with this financial statement the Board are happy to inform you that the usual annual and very liberal donation of $400 from the Directors of the Great Western Railroad has been received. Such acts of generosity, are duly appreciated by all the members, and will, we doubt not, be gratefully acknowledged by this Institution, in whose welfare the donors have manifested so much interest."

III.—The Library.

The Board have much pleasure in acknowledging the following donations of books:—

By Adam Brown, Esq.	18 vols.
" Rev. H. Hansel	1 "
" James Byrne, Esq	1 "
" C. O. Counsell, Esq	2 "
" J. W. Murton, Esq	1 "
" Wm. Haskins, Esq	2 "
In all	25

IV.—The News Room.

The cordial thanks of the Institute were tendered to the proprietors of 36 Canadian papers, for the continued liberality in supplying the Reading Room with their publications free of charge.

Fifty-eight British, American and Canadian publications are also reported as being subscribed for and regularly received.

The Directors remark that

"The News-room still continues to be regarded the best in our country, and is daily resorted to by many of the members and not a few visitors who find in it at all times the latest news from every quarter of the globe, as well as an excellent selection of the best Magazines and periodicals of the latest dates, containing information on popular and scientific subjects, from the pens of the most eminent writers of the day. The News-room may well be regarded with honest pride and enjoyed with great advantage by every public-spirited citizen of our 'Ambitious City.'"

V.—The Lectures.

In this department the Board reports that

"Despite the sparing support given to Lectures in this city, and the financial embarrassment of the Institute, your Directors, believing the Lecture to be an educational means, which it is the duty of Institutions like yours to encourage and—also to gratify, unfortunately only a minority of the members—arranged a course of Lectures during the past winter months. The Lecturers were all men of ability—two of brilliant reputation—the services of men capable to please and instruct, resident amongst us, were secured, and every effort was put forth, still the attendance, with one exception, was far from satisfactory. Your Board sincerely regret that such should be the case, but they ardently hope the members will see the necessity of seconding the efforts hereafter exerted in this direction. They trust their successors will be much more successful than themselves in this respect, and that we may yet enjoy all the advantages arising from Lectures given by gentlemen of the highest order of intellectual attainments."

One of the concluding paragraphs of the report refers to the origin, objects and tendency of Mechanics' Institutes, in the following language:—

"Glasgow had the honour of being the first place in which there existed a Mechanics' Institute. The Institution took its rise during the last year of last century, sixty-one years ago.—What Robert Raikes did for Sunday Schools, and good John Pounds did for the useful ragged schools of Great Britain, Dr. Birkbeck accomplished for Mechanics' Institutes. As its founder he merits a high place among the benefactors of our race. His name, in connection with these Institutions, will doubtless long survive the attritions of time. The professed object, as the name implies, is the improvement of our artizans and working classes of every

grade; but there is reason to fear this design has in many instances been lost sight of, or perhaps we should say, the original idea has been considerably amplified, as other classes of the community rather than operatives constitute not unfrequently the majority of subscribers and attendants."

(Signed) ADAM BROWN, *President.*
ARCH. MACALLUM, *Secretary.*

Moved by Dr. W. L. Billings, seconded by Dr. Craigie,

Resolved, that this meeting gratefully acknowledges the liberal annual donation of $400 towards the funds of this Institution, from the President and Directors of the G. W. R. Company, and that this be duly communicated by the Secretary.

The following gentlemen were duly elected Office-bearers for the ensuing year, namely:

President—F. J. Rastrick, Esq.

Vice-President—W. H. Park, Esq.

Board of Directors:

Messrs. C. Murray, D. McCullough, R. Bull, A. Stuart, A. Macallum, T. McIlwraith, G. Murison, J. F. Kidner, Wm. Michael.

CANADIAN PATENTS.

PATENTS OF INVENTION,

As issued by the Bureau of Agriculture and Statistics, Quebec, 2nd March, 1861.

William Sudworth of the Town of Woodstock, County of Oxford, Shoemaker, for "An improved process of bailing and tanning hides and skins."—(Dated 2nd November, 1860.)

Thomas Grange, of the Township of Richmond, County of Lennox and Addington, Yeoman, for "An improved Harrow Tooth."—(Dated 2nd November, 1860.)

George Kirk, of the Town of Chatham, County of Kent, Civil Engineer, for "A new and improved method of Indexing Books."—(Dated 6th November. 1860.)

James Hamilton, of the Town of Peterborough, County of Peterborough, Manufacturer of Agricultural Implements, for "An improved Grain Sower and Cultivator combined."—(Dated 21st December, 1860.)

Elijah Leonard, of the Town of London, County of Middlesex, Engineer, for "A Sawing Machine for cross-cutting timber."—(Dated 21st December, 1860.)

John D. Lawlor, of Fort Erie, County of Welland, Machinist, for "An improved Sawing Machine."—(Dated 21st December, 1860.)

Joseph Marks, of the City of Hamilton, County of Wentworth, Mechanical Engineer, for "A new system of lubricating valves, pistons, cylinders, piston rods and valve spindles of locomotives and other engines."—(Dated 21st December, 1860.)

George H. Meakings, of the City of Hamilton, Sewing Machine maker, and Isaac Mills, of the township of Flamboro' West, County of Wentworth, Yeoman, for "An article for counting and testing the quality of eggs."—(Dated 21st December, 1860.)

Thomas H. Taylor, of the Town of Chatham, county of Kent, Manufacturer, for "A self-acting cleaner for a plough."—(Dated 21st December, 1860.)

Thomas Murphy, of the village of Clifton, County of Welland, carpenter, for "A new and improved lamp for burning coal oil and other hydrocarbon liquids without a glass chimney."—(Dated 21st December, 1860.)

Peter B. B. Stiles, of the village of Beaverton, County of Ontario, Blacksmith, for "A Lifting Gate."—(Dated 21st December, 1860.)

William Gill, of the City of Toronto, County of York, Engineer, for "Certain improvements in the Flues of Steam Boilers."—(Dated 21st December, 1860.)

William Bright and James Collins, both of the Town of Guelph, County of Wellington, Machinists, for "A Clothes Airer."—(Dated 24th December, 1860.)

Nelson Kimball, of the Township of London, County of Middlesex, Mechanic, for "An improved Cultivator."—(Dated 31st December, 1860.)

Selected Articles.

ON THE ELECTRIC SILK LOOM,

BY PROFESSOR FARADAY, D.C.L. F.R.S.

"Illustrans Commoda Vitæ,"* the motto of the Royal Institution, was made the ruling principle on this the last evening of the season; an account being given of the application by M. Bonelli of electricity to the service of the figure weaving-loom. The astonishing condition of perfection to which M. Jacquard had brought the silk loom, so that artists of the highest rank could not, without minute inspection, distinguish its results from the most perfect engraving, and the manner in which he taught the weaver to construct a series of cards, and then to use them automatically, so as to produce as often as he pleased the design which they represented, are well known. Any effect of pattern, either simple or complicated, which is produced in the woven fabric depends upon the manner in which the threads of the warp are separated before the weft is thrown, and the successive re-arrangements of the warp threads which are brought about each time the shuttle is passed; a single thread of the weft therefore represents an element of the design; and in the Jacquard loom each of these requires a card pierced in a certain order, which, being brought against the ends of a set of horizontol rods, allowed some to remain undisturbed, whilst others were pushed on one side. By the action of the pedal the warp threads associated with the undisturbed rods were raised, and those belonging to the displaced rods were left unmoved; and to do this rightly, a separate pierced card was required for every thread that crossed the warp within the extent of the pattern. Frequently some thousands of cards are needed, and for the production of a woven portrait of M. Jacquard, in black and white silk, as many as 24,000 were employed.

After a design has been decided upon, it has to be converted into these cards, one for each thread of the weft included in the design; the preparation and piercing of them requires much care and time, after which they have to be linked together as an endless chain in their proper order. It is to replace this part of the weaving arrangements that M. Bonelli has applied his attention, and the peculiar power of electricity. Instead of the many pierced cards, he has but one card, or rather its equivalent, a convertible plate of brass; which, being pierced with the full number of holes required (which in the loom in action was 400), can have these holes either stopped or left open, so as to represent by its successive changes of condition the successive cards of the Jacquard series. To obtain this effect, tin-foil is attached strongly to paper, so as to form a compound sheet. The design is then drawn upon the metallic surface

* Lucretius, iii. 2.

with black bituminous varnish, and the sheet is made into an endless band, which being placed upon a roller, and kept in its position by stops, moves as the roller moves, being carried forward by its motion. A set of teeth rests on the top of this roller, touching the pattern in a line; they are made of thin brass plate, so thin that 400 of them do not occupy more than 16 or 17 inches, *i. e.* the width of the design on the roller; yet so separate that each is insulated from its neighbour by little interposed teeth of ivory; and so large and therefore weighty as to fall and rest upon the pattern, making good electrical contact where the tin-foil is exposed, but being insulated where the bituminous pattern intervenes.

Behind these teeth are 400 small electro-magnets fixed in a framework, parallel to each other, and insulated. The fine covered wires which constitute their helices are connected at one set of ends with the teeth just described, each with a tooth; whilst the other ends are brought together and made fast to one metallic plate and wire. Tracing this wire onwards, it comes to an interruptor or contact-maker from whence the metallic communication proceeds to a screw appointed to communicate with one end of a five-celled Bunsen battery, the other end of which communicates with a screw near the former. This screw has a wire proceeding from it to two insulated teeth, like the teeth bearing upon the pattern, but heavier; and these rest upon the uncovered edges of the tin-foil at the sides of the pattern, so as to keep up a constant communication with it. By simple, but perfect and secure mechanical arrangements, the following movements and results take place in this part of the apparatus. As the pedal descends under the weaver's foot at a certain time, the 400 teeth descend upon the pattern; then the circuit is completed at the interruptor in the single wire; the electric current passing through that wire, is divided into as many portions as there are teeth touching the metal in the line of pattern under realisation; it makes all the electro-magnets surrounded by these wires active, leaving the others non-magnetic; and then, as the foot is raised and the movements return in their course, the interruptor is first separated, which causing all current to cease, the magnets lose their power, the teeth are raised from the pattern; and then the cylinder carrying it moves forward just so much as to give the new line of pattern for the teeth to search out electrically (the next time they descend) which corresponds to the next cast of the weft thread. Because the pattern never moves whilst it is in contact with the teeth, it is not cut or worn by them; because the current is made by the interruptor after the teeth are in contact, and before they are separated, no fusion or burning of the metal occurs at the teeth; and because there is a tongue-wiper or brush, which, at the right time, passes under the teeth, sustains them and from off which they rub on to the pattern, there is never any want of cleanliness or of contact there.

Associated with these 400 magnets, and in the same line with them, are 400 cylinders of soft iron, called pistons; they are carried in a frame which moves to and fro horizontally between the magnets and the horizontal rods belonging to the suspensions of the wrap threads; and they move towards the magnets at a time so adjusted as to coincide with the passage of the electricity round its circuit; they find therefore some of the magnets excited, because their teeth touch the metal of the pattern: and as the box of pistons begins to return before the current is interrupted, such of the pistons as have touched excited magnets are retained or held back, whilst the others have returned in their course; the pistons therefore are divided into two intermixed groups of which the one group is perhaps half an inch behind the other. Now comes in the action of the perforated brass plate, which is to be converted for the time into the equivalent of the particular Jacquard card required, It is a vertical plate associated with the extremities of the pistons farthest from the electro-magnets: it can move up and down to a small extent: it is pierced by 400 circular holes. The 400 pistons have each a head or button, which can pass freely each through its correspondent hole when the plate is up, but is stopped at the hole when the plate is down, and then eventually closes it. Now the time is so adjusted that when the box of pistons has moved so far forward as to cause separation of the two groups, the plate descends, and by locking such of the heads as belong to the unretained group, being correspondent holes, whilst the heads of the retained group, being already behind their holes, have left them open; and so the Jacquard plate is formed, and, moving a little further, it acts on the horizontal rods before mentioned, and having by that arranged the suspenders of the wrap threads, it then goes back, or towards the electro-magnets, to take up, under the influence of the currents of electricity through the selecting teeth, the new arrangement of apertures required for the next cast of the weft thread.

The use of electricity, for the purpose of reading off the design and conveying it into the loom, involved many peculiarities, conditions, and difficulties. These were considered; and the manner in which they were either turned to advantage or overcome was illustrated by large and separate experiments.

ON THE ANTIQUITY OF THE HUMAN RACE.

BY PROFESSOR D. T. ANSTED, M.A., F.R.S.

(*Continued from page* 81.)

It only remains now to consider whether by any chance these materials have been conveyed into the places where they are found, either by some natural operations much more recent than the formation of the deposits themselves, or by some human agency of late date; in other words, whether they have drifted accidentally into holes at the surface, or whether they have been buried in graves or the foundations of buildings of a comparatively recent time. This is a question that deserves careful consideration. I have no time to dwell on the various points of evidence; but when I tell you that a dozen of the most intelligent geologists, English and foreign, most of them commencing with a decided feeling that man was far too recently introduced to admit of his manufactures being buried with gravel of any date, having examined carefully the principal localities, taken the implements themselves out of the quarry, and examined most minutely the circumstances under which they occur:—I say that when, after such investigation, a conclusion is unanimously arrived at,—namely, that these materials are contemporaneous with the gravel,—we are bound to accept that conclusion. You must, therefore take, for granted that sculptured flints of human manufacture, such as I have shown you, are found in certain beds of gravel, mixed up and of contemporaneous origin with certain bones of animals found with and near them. No one is, I think, at present at liberty to throw any doubt on this conclusion, because the investigation has been made by competent observers with perfect honesty of purpose, and by per_

sons whose integrity and knowledge of the subject is beyond any question.

I trust I have satisfied you now that flints, specimens of which are before you, and which have been found in marvellous abundance in some few localities—though hitherto only in a few—are beyond a doubt so constructed as to have required the hand of some intelligent being totally unlike in his intelligence any animal inferior to man: and also that these remains of man were found, really forming part, and often occurring in the lower part, of a great formation of gravels, and sands, and clays, or else in cavern deposits that must have taken a very long time to elaborate, and a still longer time to bring into their present position, and during the accumulation of which there lived in our latitudes large groups of quadrupeds that have long since become extinct.

Resembling in a general way the roughly-hewn implements and weapons belonging to other savage tribes, those from the gravel and caverns of England and Western Europe are yet different from them, and even of rougher make. In deposits of gravel above those which contain them are found, however, more modern specimens, similar in form, but more neatly cut, and even sometimes polished. Above these latter or amongst them, are tools manufactured of copper and iron, evidently the work of a more cultivated race. Then come the remains of the Roman conquerors of Great Britain.

At some point in the history, but probably at a comparatively recent period, lived the race to whose labours we owe the wonderful group of stones at Stonehenge, and whose cromlechs and altars are dispersed over the westernmost extremity of European land. Were these the last remains of the ancient races driven towards the sea by advancing tribes of somewhat superior cultivation and higher organization? This is a question that still remains to be answered. All we know is that the preservation of such monuments where we find them, seems to point to this conclusion, which is rendered more probable by what we see of the aboriginal inhabitants of America and Australia, who are becoming gradually lost races, owing to a similar advance of other and more civilized races.

There seems, indeed, to be a step, arrived at in the gradual modifications that take place in the human family, beyond which there is no tendency, or even power, to go back, and no power to advance, by mixture with more civilized men. When civilised men occupy a savage country we generally obtain mixed breeds, but they only last for a few generations, rapidly degenerating both physically and intellectually from the higher type without improving the lower. If this be the law of Nature, it would help to explain much that is obscure in the history of man as well of domesticated animals.

Let me now sum up what appear to be reasonable inferences from the facts we have been considering.

On land, near England, then slowly emerging out of a sea traversed by icebergs, having a climate greatly varied, but on the whole warm, there roamed, at a very distant period, elephants and rhinoreroses, large deer and musk oxen, gigantic bears, tigers and hyænas, and nnmerous smaller animals, many of which are still common. In the rivers of this land, or in pools and lakes there, were many species of hippopotamus, and we may safely conclude that there was a corresponding vegetation. It could hardly have been a small tract to support these gigantic quadrupeds; it is more likely to have been a fragment of one much larger which had been partly submerged.

The hyænas and the bears then occupied caves in the limestone rocks as dens, and carried thither their prey. The British Islands formed no separate group, and the whole Continent of Europe was probably but an archipelago. But at this time, when land was so differently distributed, when the animals, especially the larger ones, were so different, there existed tribes of savages—troglodytes, perhaps,—sheltering in holes in the ground, or sharing caverns with the wild beasts, but not without the will and the power to manufacture flint arrows and hatchets, and spear-heads, that could be fixed in simple handles with throngs, and form implements for use, or weapons for defence or offence. These early inhabitants of the western lands may not, however, have been the first, although at present no appearances of human ingenuity have been seen among the remains of the earlier and warmer land, peopled by different species of elephant and rhinoceros, and apparently by many other animals equally characteristic. The beds above the glacial drifts of the boulder clay, or the beds of boulder clay itself, contain the first yet found of those rude implements attributable to human agency.

Perhaps at this same time there existed a similarly imperfectly developed family of the human race in America; and it may be that their representatives in Africa, on the banks and at the mouth of the Nile, were then, as they certainly were afterwards, a dominant, because a more educated race.

The earliest human inhabitants of Western Europe must, however, have lived together,—they must have had a common policy,—for their weapons are all constructed according to one idea, though all are simply and roughly made, and meant for use rather than ornament. There is little symmetry of form, and often extreme carelessness of execution. So marked is this want of finish, that many of the specimens, although their character is seen which they form parts of a series, are hardly artificial enough to decide their human origin. Thousands of them are found near together; they have been shaped merely by striking one flint against another, and it seems like that for one perfect instrument made and used there were hundreds chipped off and thrown away during the progress of manufacture. This would account for the vast number of small arrow-heads or chips in comparison with the larger and more completely finished specimens.

Our early ancestors, if the tribes who constructed the flint weapons must so be regarded, may have continued with similar habits for an indefinite time. By degrees the manufacture of flint weapons probably improved, and we find in the newer gravels, in the surface deposits, and in the mouths of caverns, clear proofs of more perfect chiselling, and an approach to polish. But consider the number of years during which this change must have been going on. The climate and vegetation once permitting elephants, rhinoceroses, and hyppotamuses to flourish, must have been altered by a new distribution of land. These animals, however, spread widely, reaching even the Artic Circle; whole species were introduced, became abundant, became scarce, and entirely disappeared; while man, though adapting himself to changes that they could not endure, hardly seems to have developed sensibly in instinct or intellect. Whole tribes of human beings, the early inhabitants of unknown lands, have doubtless been replaced by other families of the great human race. Generations after generations have been born—have lived, and died—tribes have succeeded tribes, families have driven out families, and scarce anything is left behind but a few spear-heads and flint hatchets buried in caves with the bones of the bears and hyænas, or mixed with ancient gravels collected when the elephant was perhaps as common as the man. But the stamp of time is indelibly impressed on these rude flints, not less clearly than the marks of their human origin; one has a coating of white decay on the surface; another, little crystals of maganese; almost all have something to substantiate the inference that they are of equal antiquity with the stones and the bones with which they are found.

Not the less certain is it that man is a creature of yesterday. For every year that has elapsed since he appeared, centuries have passed away in the elaborate preparation for his presence. The ocean had covered the depressions of the land, and had helped to produce the successive deposits; the depths of the ocean had received film after film of fine mud, the remains of animalcules; the iceberg had carried and accumulated numerous deposits; the shores and shallow depths of the ocean had been peopled from time immemorial with animal and vegetable forms of life long before even the commencement of the last great period. There were then, however, other continents, and the groups of islands of that time were the summits of our mountains. Central Africa and Central Australia were then vast lagoons, having an outer wall of low islets. Earthquakes, however, then disturbed and elevated the lands, and there were eruptions from volcanoes which differed perhaps but little in intensity from those recently described, though the rents were not where they now are seen. Then, as ever, water circulated through the earth, and rocks were in the course of formation, governed by the same laws as those we still trace, and which are concerned in reconstructing the ever shifting framework of the earth.

With these few general and connecting remaks, I now bring to a conclusion my somewhat disconnected discourse. It occurred to me—and I believe I may venture to hope that I was not mistaken—that a sketch of the present condition of some questions in geology and physical geography would afford matter for useful and interesting illustrations; and now, in taking leave of you, let me very briefly show you how living and present is the interest in most of the subjects I have put before you.

Within the brief weeks that have passed since my first Lecture, an unusual condition of the Atlantic Ocean has been more than once the cause of some of those fearful and destructive cyclones, or spiral storms, that desolate the earth and sweep along our shores. One of these we have experienced since we last met. Before long we shall probably learn that the icebergs coming down from the Polar Seas are of unusual dimensions, and reach to latitudes seldom visited by such phenomena.

Within a few days it has been determined to send out an expedition to sound the depths of the Atlantic in a new direction, with a view to repeat under more favourable circumstances the experiment of connecting America with Europe by a telegraphic cable. I am happy to know that on this occasion there will be a naturalist on board, as capable as he is willing to clear up all the doubtful points with regard to the mud of the ocean floor and its contents, living or dead.

At the present moment I trust our brave countrymen are busy exploring still further Central Africa and Central Australasia. Captain Speke is on his way to trace the waters of Lake Nyanza, north of the equator hoping thence to reach and descend the Nile; and Dr. Livingstone, from the mouth of the Zambesi, is filling up the gaps that still remain in our maps of the east coast of Africa.

Since I spoke of earthquakes, we have been told in the public newspapers of feartul and destructive shocks destroying one of the chief cities of Peru; and it is not improbable that these may have terminated with a violent volcanic outburst. Vesuvius seems to be symbolising at the present moment the political uneasiness of Italy.

In all these, and indeed in all departments of science and natural history, knowledge is increasing; and the discoveries of one department are every day more clearly seen to bear on every other. If then, we pause for a time from other avocations for the purpose of acquiring general information and learning what is most recently discovered in science, we find that before we have even completed our inquiries, new discoveries, new methods, new views are thrusting themselves forward, threatening to displace the very novelties we have hardly prepared ourselves to admit. It is only thus that we can learn the enormous difficulties that lie in the way of successful generalisations, and excuse the shortcomings incident to attempts like that which I have undertaken, and which I now terminate.

EXTRACTS FROM THE REPORTS OF H. B. M. CONSULS.

Beet-root Sugar.—The cultivation of the beet-root for the manufacture of sugar has of late years received an immense development in the kingdom of Poland and in the adjoining provinces of Russia. The first factory was established in 1831, and the first refiners in 1839. The manufacture had increased to such an extent that in 1856 there were 52 factories in the kingdom; thirty-five were to be found in the government of Warsaw alone. The conversion of beet-root into sugar is entirely performed between the end of September and the commencement of April in each year, beyond which time the beet-root if kept becomes deteriorated. The total quantity of loaf sugar and sugar of a coarser character made in the season 1856–57 amounted to 29,013,000 lbs.

Latakia Tobacco.—The best exported from Latakia is that produced in the district of Gebel. When this has been hung up in the rooms of the peasants, and there allowed to absorb the smoke of the dwarf oak, it gives a delicious perfume in smoking. It is then called Albu Richa (Father of Scent). It is worthy of observation that the Albu Richa improves a great deal after having been some days on board ship. In Egypt it is in great demand. The peculiar property which this tobacco derives from being exposed to the smoke was accidently discovered as follows:—One year there being no demand for tobacco, the leaves were hung up for the winter in the peasants' huts, exposed to the continual smoke of their fires, and the succeeding year it was sent to Egypt, where it was considered so good that a large order was sent to Latakia for more of the same quality, which was then called Albu Richa.

Oil from Vancouver's Island.—The oil exported from this colony is procured from the native tribes inhabiting the west coast of Vancouver's Island, and is manufactured by them from the whale and dog-fish; it is of excellent quality, and has a high character in California, where it brings from two or three dollars a gallon, in consequence of its retaining its fluidity freely in the coldest weather.

It is estimated that a quantity equal to 10,000 gallons was purchased from the natives of the west coast in 1854; and considering the imperfect means they possess for taking the fish, and frying out the oil, it is not unreasonable to suppose that with the use of proper means, the returns of oil would be very greatly increased.

The oil trade is carried on by a few enterprising individuals who live among the Indians, and collect the article as it is manufactured by the natives.

Ship Spars.—A source of wealth and enterprise may be found in the magnificent ship spars produced in Vancouver's Island, which, in point of size and comparative strength, are probably the most valuable in the world, and may be procured in any number, even were the demand to include the supply of spars for the whole British navy. A company was formed in this country for the exportation of ships' masts and spars to England; but the parties finding that they had not a sufficient command of capital for the undertaking, discontinued the business, after preparing two cargoes of excellent masts, from 75 to 120 feet in length, which still remain on hand.

Neat's Foot Oil.—Quantities of neat's foot oil, obtained from the wild animals of Abyssinia, are sent to America.

Wine and Silk.—In Ancona the vine disease has continued for six years, and the good wine which formerly cost three-halfpence per bottle is now fourpence-halfpenny per bottle, which is considered excessive. The mulberry plantation is yearly increasing throughout the country to augment the production of silk.

Cochineal.—In consequence of the continuation of the vine disease in the island of Maderia, since the commencement of 1852, the cultivation of the cactus for the propagation of cochineal has increased, and is likely to become a source of considerable profit to the island.

The production of cochineal in Teneriffe has made immense strides during the last ten years.

Raw Sugar from Beetroot, is manufactured at Dunkirk, is imported into England, where, after being refined, it can be sold for 5½d. per lb.; if refined at Dunkirk, and sold there, the same sugar costs 8d. per lb.

Leather.—At Leipzig leather becomes every year a more importaut branch of German industry. Above a million of hides are annually prepared for sole-leather alone within the Customs' Union, and the whole quantity of leather produced is estimated at 140,000,000 lbs. annually, of which tanned leather forms 80 per cent.

India Rubber and Gutta Percha.—A tree yielding india-rubber and the gutta-percha tree are both found in large numbers on the banks of the Zambesi river, and the Governor-General of Mozambique has been requested to issue an order forbidding any gutta-percha tree being cut down, and pointing out that they should be tapped longitudinally for the extraction of the juice.

India Rubber.—The demand for india-rubber, the principal and staple product of Para (Brazil) has diminished, and is diminishing, in consequence, in a great measure, of the quantity produced on the west coast of Africa and our East India possessions, and in some degree from its having for many purposes been superseded by gutta-percha, and its application to other purposes relinquished. It is now at least 120 per cent. cheaper than it was in 1854.

Coal.—It is now evident that a grand coal-field exists at St. Catharines, (Brazil), of sixty leagues, in an east and west direction, that is, from the sea-coast of the Atlantic Ocean to St. Gabriel, and perhaps much further; and along the coast, probably 140 or more leagues, beginning from Laguna, in the province of St. Catharine, and continuing south almost to Monte Video. These mines of the Erral, so called, are not of the best quality, but they have not been explored beyond thirty yards in depth, because coal has been found at Arrico dos Katos, much more convenient to the village of Sao Jeronymo, situated on the margin of the river Jaculay, and the nearest place for embarkation being only two leagues, whilst the mines of Erral are ten leagues off. Sao Jeronymo is twelve leagues from Porto Alegre, situated on the left-hand side of the river, but opposite Triumfo, called in most of the maps Villa Nova At Arroio dos Katos, the first seam of coal was found by boring-rods, at forty-five yards deep, and the seam is five feet in thickness. It is steam coal of very good quality; some hundred yards of galleries have been worked, which have supplied the steamers of the province. Forty yards below this seam another four-feet seam has been discovered, of even better quality than the five-fee seam. There are many leagues of these two seams. Coals have also been found in many other parts.

Spirit from Currants.—At Patras (Greece) a Joint-Stock Company is being formed, under the auspices of the Government, for distilling wine and spirits from the inferior descriptions of currants, and it is proposed to bring clever workpeople and manufacturers of wine and spirits from France and Sicily.

Mules.—Naturalists may be interested in knowing that in Aleppo a mule between a donkey and a cow, is now and then met with. Its appearance is very striking—in shape like its mother, but with solid hoofs, and without horns.

Silk is the richest production of the Austrian Empire, in which the total mean annual quantity of six cocoons produced reaches 27½ millions of kilogrammes, about 60,630,000 lbs. avoirdupois, which, at Austrian livres, is equal to about £4,230,600.

The production is divided as follows:—

	Kilograms.	Lbs.
Lombardy	15,000,000	33,075,000
Venice	10,200,000	22,491,000
Tyrol	1,568,000	8,447,440
Other Provinces	672,000	1,481,760
Total	27,440,006	60,505,200

Cowrie Shells.—One Hamburgh house sends annually fourteen vessels to Zanzibar for cargoes of cowries, with which they proceed to the rivers on the west coast of Africa, and purchase cargoes of palm oil.

Gold.—Solfala is situated at the mouth of a river of the same name, in latitude 21 deg. 11 min. south, and longitude 34 deg. 45 min. east. The Solfala river leads to the auiferous portion of Eastern Africa. Solfala is considered the ancient Ophir of Solomon, in whose days ships were sent from Tarshish to obtain gold from mines which are even now as productive as ever, but entirely neglected. The only gold at present sent from Solfala is a small quantity occasionally picked up on the sur face of the earth after heavy rains. On both banks of the river Solfala, and from that river northwards to the southern bank of the Zambesi, the country is one mass of mineral wealth—gold, silver, copper, and toward Tete even iron and coal being found in abundance. Ruins of cities, once the dwelling place of nations mighty in their industry, are to be seen in this region—perhaps telling the history of those who provided gold for the Temple of Solomon.

Gold, Silver, and Malachite.—The natives from the interior being down to Messourie, on the mainland opposite the city of Mozambique, every year gold, silver, ivory, wax, skins, and malachite, the latter in considerable quantities, showing that there are mines of copper in the Monomoises country. When Mozambique was in the hands of the Arabs an important trade was carried between Arabia and India, but for the last 200 years, under its present rulers, the trade, principally carried on by Banyans to Cutch and Goa, has been gradually decreasing. At present it exports of ivory annually 250,000 lbs., beeswax, sesame seed, archilla, rhinoceros horns, cocoa nut oil, castor oil, ground nut oil, cork, arrowroot, sago, coffee, tortoiseshell, indigo of an inferior quality, from ignorance in manufacturing it, and a spirit made from the cachu.

Nut-galls.—At Eatakla, in Turkey, nut-galls, and wax, can be had for the gathering; also cochineal, but they are not now collected. Ibrahim Pacha forced the peasants to gather all three.

Leather.—A considerable quantity of skins of the wild boar are sent from Latakia to Mount Lebanon, where they are tanned, and sent back to Latakia. The leather is used for the soles of shoes. Abundance might be had for export. Saddlers there do not make use of them.

Ancient Vases and Gold Ornaments are often picked up by the inhabitants of the Island of Astropalia or Stampalia, in the Ottoman Archipelago. It is a singular fact that no serpents or reptiles exist on the island, and although they are sometimes found among the firewood which is imported, they do not live.

Flavour of Mutton.—The flesh of the sheep of the island of Halki is highly esteemed, it having a delicious taste, in consequence, it is said, of the animals drinking only salt water. This fact is said to be well attested.

Gum Mastic is obtained from a tree of the same name. The tree rarely exceeds 8 feet in height; its leaves are evergreen, and resemble those of the turpentine tree. Mastic is one of the principal resources of the Island of Scio. To extract the gum, incisions are made on the main trunk of the tree, and from them the gum issues. Previous to 1850, the trees produced from 45,000 to 50,000 okes; but in consequence of their being killed by the frost in that year, the quantity was greatly reduced, but, ln 1858, 20,000 okes were collected. The mastic tree cannot be cultivated except in the north part of the island, and all attempts to propagate this tree, whether in other parts of the island, or in other countries, have totally failed.

Brandy.—The brandy of the island of Scio is considered the best in Turkey, chiefly on account of the mastic put with it, which gives it a peculiar flavour. It is sent to Constantinople to the value of nearly one million piastres yearly.

Saw-Mills.—The number of saw-mills in the State of California, U.S., is 388, of which 178 are propelled by steam and 210 by water; and their aggregate capacity is 500 millions of feet (board measure) per year.

The Climate gf South Carolina.—The climate of this region is healthy during the winter months, but deadly to whites from May to October, a single night passed on a rice plantation being sufficient to induce an attack of the so-called " country fever," a billious fever of the most malignant type, more dangerous even than the yellow fever.

NOTICES OF BOOKS.

Turning and Mechanical Manipulation. By Charles Holtzapffel, Associate of the Institution of Civil Engineers, London, &c., &c. London: Holtzapffel & Co.

Though chiefly intended for general reference and practical instruction for amateurs, this comprehensive work will be found to contain a great deal of valuable information for the practical mechanic, and ought to have a place in the library of every Mechanics' Institute. It was originally designed to extend to six volumes, but the death of the author just before the publication of the third, prevented its accomplishment, and we have only the three first volumes of the work, each of which is, however, complete in itself.

The first volume, besides containing a descriptive catalogue of the characters and uses of the various woods generally employed in the mechanical and ornamental arts, treats of materials, their structural differences and physical characteristics, and their uses in the mechanical arts. The various modes of preparing, working and joining the materials, with the practical description of a variety of processes which do not generally require the use of cutting tools. The second volume is devoted to the principles of construction, action, and application of cutting tools used by hand, viz.: chisels and planes, turning, boring and screw-cutting tools, saws, files, shears and punches; together with a description of various machines in which the hand processes are more or less closely followed.

Vol. III. describes various abrasive and miscellaneous processes which cannot be accomplished with cutting tools. And besides containing a descriptive catalogue of the apparatus, materials and processes for grinding, and polishing, commonly employed in the mechanical and useful arts; full instructions are given for the figuration of materials by abrasion, such as glass-cutting, the grinding and polishing of lenses and specula, both by hand and with machinery; the various descriptions of lapidary work, together with a chapter on seal, gem, and glass engraving, and cameo cutting; and full directions for the preparation and application of varnishes and lackers.

We cannot too highly commend this book to the attention of Mechanics. It is well written, and the various processes of which it treats are so clearly described, that they can readily be worked by persons previously unacquainted with them. It is to be hoped that the original design of the author may yet be carried out, and the work completed by the publication of the remaining three volumes, as there is at present no general treatise in the English language on these subjects.

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

SUPPLEMENT TO THE JOURNAL

OF THE

Board of Arts and Manufactures

FOR UPPER CANADA.

Vol. I. APRIL, 1861. No. 4.

The Board of Arts & Manufactures

FOR LOWER CANADA.

PROCEEDINGS OF THE BOARD.

The following Report of the Special Committee of the Board of Arts and Manufactures for Lower Canada arrived after the April number of the Journal had gone to press. The Sub-Committee of the Upper Canada Board, at their meeting on the 2nd April, considering the importance of the suggestions offered by the Committee of the Lower Canada Board, decided to issue a Supplement, embracing the Report and Classification of the Products of Canada recommended by the Lower Canada Board.

The whole question of the selection and arrangement of materials for the International Exhibition will be re-considered by a general Committee, which will no doubt be appointed by the Government. Any difference in details which might be supposed to exist between the views entertained by the Committees for either Board can then be discussed, and a general plan of operations adopted, based upon their suggestions and others which may be advanced by different bodies or private individuals.

Report of the Special Committee.

The Committee of the Board of Arts and Manufactures for Lower Canada respectfully submit, that having fully considered the report on the coming Exhibition, prepared by the Committee of the Board for Upper Canada, and referred to them; they are of opinion that the introductory remarks, explanations and suggestions of that Committee are excellent and appropriate to the occasion, therefore they have much pleasure in recommending them for adoption by the Board for Lower Canada.

With reference to the classification of the products of Canada, the Committee is of opinion it is best at once to prepare and publish a list regularly arranged as nearly as possible in strictly scientific and practical order, without going too far into details which must necessarily be entered into hereafter. In accomplishing this, they have availed themselves of the information and experience of gentlemen, members of the Board, who have had opportunities to acquire scientific as well as practical knowledge in the various departments referred to. Therefore, the accompanying "Proposed Classification of Canadian Products" is respectfully submitted for the adoption of the Board for Lower Canada, in connection with the remarks and suggestions of the Committee of the Board for Upper Canada, and they would recommend that copies be forthwith forwarded to Toronto, hoping that that Board will not object to the adoption of the whole as being the result of the joint deliberations of the Boards of Arts and Manufactures for Upper and Lower Canada.

The Committee desire further to remark that in making arrangements for the ensuing Exhibition, it is desirable the Boards should be so intimately identified with it, as to be enabled to secure permanent advantages for the trade of the country, and its Arts and Manufactures.

Submitted on behalf of the Committee,

William Rodden,
Vice-President.

Board Rooms, Mechanics' Hall,
Montreal, 25th March, 1861.

Proposed Classification of Canadian Products.

It is proposed in classifying the various Natural and Industrial products of Canada to group them under the following heads:

Department I. Natural Products.

Class 1. Mineral.
" 2. Vegetable.
" 3. Animal.

Department II. Agricultural Products.

Class 1. Field.
" 2. Dairy.
" 3. Domestic.

Further details to be left to the Boards of Agriculture, who, no doubt, will ably discharge such duties as properly belong to their Department.

Department III.—Manufactures.

Class 1. Chemical.
" 2. Wood, and wood with other material.
" 3. Musical Instruments.
" 4. Agricultural, Horticultural, Dairy and Domestic Implements.
" 5. Metals prepared for manufacturing purposes.
" 6. Manufactures of the various metals and Minerals.
" 7. Machinery and Implements.
" 8. Textile.
" 9. Leather.

Department IV.—Fine Arts.

Class 1. Statuary.
" 2. Painting and Drawing.
" 3. Photography.
" 4. Engraving.
" 5. Modelling and Ornamental Design.

Department V.—Ladies' Work.

Class 1. Painting and Drawing.
" 2. Millinery, Apparel and Needlework.
" 3. Ornaments and Preparations.

Department VI.—Miscellaneous.

Productions not provided for in foregoing Departments.
Indian Work.
Antiquities and Curiosities.

It is proposed to make the following subdivision of Departments and Classes.

Department I.—Natural Products.

CLASS 1.—MINERAL.

Metals and their ores.
Minerals applicable to Chemical Manufactures.
Mineral Paints.
Materials applicable to the fine arts.
Materials applicable to Jewellery.
Materials for Glass-making.
Refractory Materials.
Grinding and Polishing Materials.
Materials applicable to the purposes of common and decorative construction.
Miscellaneous Materials.

CLASS 2.—VEGETABLE.

Woods in the natural or roughly prepared state.
Plants, Leaves, Barks and Gums of Canadian Forests.

CLASS 3.—ANIMAL.

Skins of Animals of Canada.
Animal substances used in Manufactures.
Preserved specimens of Canadian Animals.
Zoological specimens.
Products of the Fisheries and the Chase in their natural state.

Department II.—Natural Products.

Class 1. Field.
" 2. Dairy.
" 3. Domestic.

Further details to be left to the Boards of Agriculture, who, no doubt will ably discharge such duties as properly belong to their department.

Department III.—Manufactures.

CLASS 1.—CHEMICAL.

Chemical Products and Preparations.
Sugars, Syrups, Cordials, Sauces and Pickles.
Vinegars and Wines.
Confectionery, plain and ornamental.
Preserved Fruits and Vegetables.
Tobacco, Manufactured and Unmanufactured.
Soaps and Candles, plain and fancy.
Paints, Colours, and Varnishes.
Oils, Mineral, Vegetable, and Animal.

CLASS 2.—WOOD AND WOOD WITH OTHER MATERIAL.

Specimens of Wood, cleaned and prepared.
Building Materials and Trimmings in Wood.
Carpenters, Joiners, and Turners work.
Cabinet Wares and Furniture.
Articles of Domestic utility.
Carriages or Sleighs, or parts thereof.
Wooden Models of Inventions, Designs or Improvements.

CLASS 3.—MUSICAL INSTRUMENTS.

Organs, Harmoneons, and Melodeons.
Pianofortes, Violins, &c., &c., &c.

CLASS 4—AGRICULTURAL, HORTICULTURAL, DAIRY AND DOMESTIC IMPLEMENTS.

Field Implements and Machines.
Labour Saving Implements and Machines.
Dairy Implements and Machines.
Domestic implements and Machines.

CLASS 5—METALS PREPARED FOR MANUFACTURING PURPOSES.

Pig, Bar, Sheet and Hoop Iron.
Pig, Bar and Sheet Lead.
Pig, Bar and Sheet Copper and Brass.

CLASS 6—MANUFACTURES OF THE VARIOUS METALS AND MINERALS.

Manufactures in Cast Iron, plain and ornamental generally, including Stoves, Grates, Furniture and hardware.
Manufactures in wrought iron, light and heavy, plain and ornamental, and wire work.
Nails, Spikes, Brads, Tacks.
Manufactures in Brass, Copper, Zinc, Tin, Lead, and composition of Metals.
Lamps, Chandeliers and Gas Fixtures.
Castings of Iron, Brass and composition of metals.

CLASS 7—MACHINERY AND IMPLEMENTS.

Mill work and Engine work.

Railway, Hydraulic, and other Machinery.

Models of Machines and Implements, useful or Instructive.

Machines in operation, shewing any new means or process of manufacture.

Machines in use, new manner of labour-saving.

CLASS 8—TEXILE FABRICS.

Straw, Flax, and Hemp, and the manufactures thereof.

Cotton and the manufactures thereof.

Wool and the manufactures thereof.

Cloths, Satinets, Flannels, Shawls, Blanket and Carpeting.

Articles manufactured of Linen and Silk, or mixtures thereof with other materials.

Wearing Apparel, Civilian and Military.

Hats, Caps, and Head Dresses.

Cordage, Lines, and Twines.

CLASS 9.—LEATHER AND LEATHER MANUFACTURES.

Morocco, Enamelled, Porpoise and Patent Leather, Sole, Upper, Skirting, Binding, Harness, Hose, Belt, Lace, Carriage top, and other Leathers.

Harness and Saddlery.

Trunks, Bellows, Belting and Hose.

Boots, Shoes, Moccasins, Mits and Gloves.

Military fittings.

Department IV.—Fine Arts.

CLASS 1.—STATUARY.

Sculpture and Statuary in Marble or Stone.

Statuary, in Bronze, composition or other material.

CLASS 2.—PAINTING AND DRAWING.

Paintings in oil.

Drawings in Water Colours.

Crayon Drawing.

Pencil Drawing.

Pen and Ink Sketches.

Lithography.

CLASS 3.—PHOTOGRAPHY.

Photographs.

Ambrotypes.

Daguereotypes.

CLASS 4.—ENGRAVING.

Engraving on steel.
" on copper.
" on wood and other metals.
} with proof in print.

CLASS 5.—MODELLING AND ORNAMENTAL DESIGN.

Mechanical, Architectural and ornamental Drawing, designing and mapping.

Models in paper, card, wood, or other material.

Ornamental work of any or various material.

Department V.—Ladies' Work.

CLASS 1.—PAINTINGS AND DRAWINGS.

Paintings, in Oil or Water colors.

Sketching, Drawing and Mapping.

Crayon and Pencil work and Penmanship.

CLASS 2.—MILLINERY, APPAREL, AND NEEDLE WORK.

Millinery and Decorations.

Lace, Fringes, Trimmings, in any material.

Knitting, Netting and Crotchet Work.

Worsted Work and Embroidery.

Quilts, Counterpanes, Curtains and Covers.

Needle Work in any material.

Ladies' and Children's Clothing.

CLASS 3.—ORNAMENTS AND PREPARATIONS.

Preserved Dried Leaves and Flowers of Canada.

Articles (useful and ornamental) made of Straw, Hair, Feathers, Paper, Wax, Shell or Composition.

Written Composition, Words with Music.

Department VI.—Miscellaneous.

Penmanship and Printing.

Painters' Work generally, on any material.

Bookbinder's and Stationer's Work.

Paper and Stationery, plain and ornamental.

Carving, and Carving and Gilding.

Gilding, Silvering and Bronzing.

Gold, Silver and Plated Work.

Dental and Surgical Instruments.

Philosophical and Mathematical Apparatus.

Clocks, Watches and Jewellery.

Work on Marble and Stone, for building and ornamental purposes.

Bricks and Tiles, for building and other purposes.

Glass and Earthenware.

Brushmaker's and Combmaker's Work.

Furrier's Work, and Material manufactured and prepared for manufacturing.

India Rubber goods.

Indian Work, in Bark, Hair, Skins, &c., &c.

Bark Canoes, Paddles, Bows and Arrows, Snow Shoes, and Basket Work.

Canadian Antiquities and Curiosities.

Meat, Fowl, Fish, and other Products put up for keeping or exportation.

In arranging the foregoing Classification, your Committee have endeavoured to be guided by the Natural, Scientific, and Mechanical order of things, their past experience having convinced them of the great importance of a careful arrangement. There are, however, many details which it is not now necessary to mention.

Copy of the Memorial

Proposed to be submitted by the Board of Arts and Manufactures for Upper Canada on the subject of the International Exhibition, to be held in London in 1862.

"Your memorialists respectfully beg leave to address your Honourable House on the subject of the International Exhibition to be held in London in 1862.

"Your memorialists have the best grounds for the expectation that the proposed Exhibition will exceed in importance and grandeur those illustrations of progressive Industry and Art which elicited the astonishment and admiration of the civilized world, at London in 1851, and at Paris in 1855.

"Your memorialists consider that the honourable position acquired by Canada at those Exhibitions greatly contributed to diffuse information throughout Europe respecting the resources of the Province, to draw the attention of emigrants to it as a field for industry and settlement, as well as to induce numbers of commercial men and capitalists to make it their home or the scene of their enterprise.

"Your memorialists believe that the progress which has been made in our knowledge of the resources of Canada since the year 1855 might greatly enhance the value of any display that could be made in 1862. They believe that the advance in our civilization during the past six years will, if properly represented, exercise a proportionately greater effect upon those who may have the opportunity of comparing 'Canada in 1862' with 'Canada in 1855' or 'Canada in 1851.'

"But while your memorialists are firmly persuaded of the great benefits which might accrue to the country from a proper representation next year at London, of its resources and the civilization of its people, they also believe that without ample pecuniary assistance from Your Honourable House that great object can not be attained.

"With a view to enable our countrymen to exhibit the Progress of their Industry, the increased Extent and Value of the Resources at their command, their Growing Power as an Industrial People, your memorialists humbly pray that Your Honourable House will be pleased to grant that a sum not less than $60,000 of public money may be expended, under proper supervision and control, in assisting to secure a fit representation of the Resources and Civilization of Canada at the International Exhibition of 1862.

"And your petitioners will ever pray, &c."

ASSOCIATION OF ARCHITECTS, CIVIL ENGINEERS, AND PROVINCIAL LAND SURVEYORS OF CANADA.

At a meeting of this Association held in Toronto on the 6th February last, George Brown, Esq., of Montreal, 1st Vice-President, in the chair, the question of an uniform system of measurement of Artificers work was brought up on a report from the Special Committee. The subject was very fully discussed, there being a very large number of members present, who took great interest in the matter. The report recommended the application of a decimal system similar to that in general use on the Continent of Europe, but the majority considered that such a mode, however convenient, would be next to impracticable in this Province. It was therefore resolved to refer back the report, with instructions to adapt, as far as possible, the system set forth in Laxton's *Price Book*, which contains the rules regulating the general measurement of work in England. A Paper was received from Mr. Hanvey, of St. Thomas, "On the Allowance to be made for the Curvature of the Earth in Surveying," which was appointed to be read at the next meeting. A resolution was passed sympathising with the family of the late lamented President of the Association, Wm. Thomas, Esq. The 1st Vice-President, Mr. Brown, having vacated the chair, a vote of thanks was accorded him for his zeal in making a journey from Montreal at so inclement a season of the year to attend the meeting, and for his able conduct in the chair. The meeting then adjourned.

The Association met again at Toronto for the nomination of officers, on the 6th March last, Wm. Hay, Esq., Architect, Toronto, in the chair. After the nomination, which was the chief business of the meeting, an interesting discussion ensued on Mr. Hanvey's paper, presented at the previous meeting, in which Mr. J. O. Browne, of Toronto, Mr. Peters, of London, and others, took part. The question greatly affects the practice of surveying in this Province, where frequently the first line of a survey is run on a true meridian, and the others parallel or rectangular to it. It was generally admitted that the polar lines should be true local meridians, and that some alteration in the Statute directing the mode of surveying for the Province is required. Mr. Peters having been called to the chair, a vote of thanks was given to Mr. Hay for the able manner in which he presided at the meeting.

THE JOURNAL
OF THE
Board of Arts and Manufactures,
FOR UPPER CANADA.

MAY, 1861.

COTTON, WOOL, AND FLAX.

An analysis of Human labour in the aggregate shows many startling results. Few care to know how the masses earn their daily bread, or in what pursuits the majority of their fellow creatures in the old monarchies of Europe sustain existence from year to year, and often acquire a comfortable maintenance, sometimes affluence, and rarely rank and power. It is not a subject of general interest to know that in the United Kingdom, there is one person in every 72 of the population employed in a Cotton factory, while in Switzerland there is one in 100, in France one in 132, and in Austria one in 1,312, so spending their lives. Such knowledge however is of great value to the statistician, the politician, and the philanthropist. It shows the direction of labour, and from it the condition of a country in 10 or 12 years time, other things being equal, may be predicated with a considerable degree of certainty. The relative quantities of textile fabrics consumed per head by the people of the United Kingdom and Austria are in the proportion of £2 6s. 3d. sterling against 14s. 1d. In France the proportion of these fabrics consumed per head amounts to £1 4s. 7d. These items, insignificant as they appear, prove that the people of Great Britain and Ireland can afford twice and three times the amount of clothing indulged in by the Austrians and French ; and that whilst the British people not only clothe themselves with comparative luxury, they are enabled to send to other nations, if they will admit them, as many of their moderately priced comforts and luxuries of clothing as they require, and thus help to raise the comfort of the masses among many foreign people to a degree of equality with their own.

A very able paper has recently been read before the Society of Arts "On the progress of textile manufactures in Great Britain," by Mr. Alex. Redgrave, one of Her Majesty's Inspectors of Factories. The facts elicited during the discussion on this important paper were of the greatest interest, and possess an attraction quite apart from their statistical or commercial value, on account of the insight given to the public respecting the manner in which a large part of the textile fabrics sent into the market are produced. We shall endeavour in this article to give a summary of Mr. Redgrave's paper and the discussion which followed.

There are four classes of raw products convertible into textile fabrics:—these are cotton—wool and worsted—flax, hemp, and its tribe—and silk. Wool and worsted, although the same material, are of a different nature, and require to be manufactured in a different manner; they are, therefore, treated of separately, and it is usual to divide the textile fabrics into five classes.

The cotton trade represents more than one-half of the whole of the textile fabrics.

The woollen manufacture, once the chief textile industry of the country ranks second in importance.

Worsted, which is obtained by separating the long fibre of the wool from the shorter staple, ranks as the third.

Flax is fourth ; and silk is the fifth and last.

There are various methods of exhibiting the extent of these manufactures, in some of which, perhaps, the order in which they are enumerated might be varied, but taking the general importance and probable value of the several branches of manufacture, the order in which they have been named will be found the most correct.

Statistics have been procured, at intervals, by the Inspectors of Factories, with reference to the establishments under their supervision, viz., those in which either of the raw materials enumerated are spun or manufactured. No account has ever been taken of the print-works, bleaching and dyeing works, lace factories, &c., which are excluded from the operation of the Factory Acts, and the following figures refer, therefore, to those establishments only in which the first processes of manufacture, up to and including the weaving, are carried on by the aid of water or steam power.

	No. of Factories.	Horse-power.
Cotton	2,210	97,132
Wool	1,505	25,901
Worsted	525	14,904
Flax	417	18,322
Silk	460	5,176
	5,117	161,435

	No. of Spindles.	No. of Power Looms.
Cotton	28,010,217	298,847
Wool	1,786,972	14,453
Worsted	1,324,549	36,956
Flax	1,288,043	7,689
Silk	1,093,799	9,260
	33,503,580	367,205

	No. of Persons Employed.		
	Males.	Females.	Total.
Cotton	157,186	222,027	379,213
Wool	45,583	33,508	79,091
Worsted	30,023	57,771	87,794
Flax	23,446	56,816	80,262
Silk	16,899	39,238	56,137
	273,137	409,360	682,497

Mr. Redgrave estimates that there are 682,497 persons employed in establishments subject to the factory act, and 887,369 persons employed upon textile fabrics—in establishments not under the provisions of the factory act, which two classes of persons have dependent upon them at least 3,000,000 of unemployed persons, representing a total of 4,568,082 persons dependent upon the textile fabrics for their maintenance; being in the proportion of 16 per cent., or one-sixth of the population. But there are others, though not directly employed upon the fabrics themselves, equally dependent upon the prosperity of textile manufactures for their subsistance—for instance:—

Those engaged in the procuring of coal (at least 3,000,000 tons are consumed per annum in factories, print-works, &c.). Those engaged in the procuring of iron, engine and machine makers. Those engaged in the leather trade, in the manufacture of grease, in the procuring of oil, dry wares, paper, skips, or baskets, and of various minor articles used in manufacturing establishments. Those employed in warehouses, &c., &c.

At a moderate computation, the above persons and their families would raise the number of those dependent upon the textile fabrics to 20 per cent., or one-fifth of the population.

The following table shows the relative strength of the different countries in relation to cotton fabrics.

Countries	No. of Factories.	No. of Spindles.	No. of Persons employed.
Austria	202	1,500,000	30,020
Bavaria	18	558,700	12,000
Belgium	169	600,000	12,000
France	2,394	3,457,552	244,579
Prussia	132	194,290	5,201
Russia	70	1,400,000	50,000
Saxony	134	604,646	12,000
Switzerland	132	1,112,625	20,000
The smaller States of Germany	30	440,000	8,000
	3,281	9,867,813	393,800
Great Britain & Ireland	2,210	28,010,217	379,213

The above number of spindles, say in round numbers 10,000,000, are known to be in operation in certain countries in Europe, being those most engaged in industrial pursuits, and containing an aggregate population of 160,000,000. If to the remaining countries, containing a population of 55,000,000, we give 4,000,000 spindles, which is a very large estimate for Spain, Portugal, Italy, Turkey, Greece, Denmark, Holland, &c., it will be found that the continent of Europe gives employment to 14,000,000 spindles. To this number must be added the probable number in operation in America, which has been estimated not to exceed 7,000,000. There will then be a total of 21,000,000 out of England, tended by every variety of race, each with their different characteristics and habits, while in Great Britain alone there are 28,000,000, tended by industrious, intelligent, and steady operatives.

From a comparison of the Table just quoted with the first Table, the following results are obtained:—That in the United Kingdom there is one person employed in a cotton factory to every 72 of the population.

In Switzerland	One in every	100
France	"	132
Saxony	"	141
Prussia	"	300
Belgium	"	350
Bavaria	"	416
The smaller States of Germany	"	625
Austria	"	1,313

The following shows the value of the textile fabrics manufactured in the United Kingdom in 1856:—

	Estimated value of Goods manufactured	Quantity exported	Estimated quantity consumed in the country.
	£	£	£
Cotton	55,298,778	38,283,770	17,015,008
Wool	23,942,976	5,985,744	17,975,232
Worsted	12,715,569	6,415,569	6,300,000
Flax	15,100,000	6,262,588	8,837,412
Silk	18,900,000	2,966,938	15,933,062
Total	125,957,323	59,914,609	66,060,714

It is commonly believed that notwithstanding all the appliances of science, art, and marvellous skill, the hand looms of the East surpass in the beauty and delicacy of their productions the most elaborate efforts of the British manufacturer.

The beauty, softness, and delicacy of the fabrics of India have long been celebrated. We are accustomed to think of them with wonder, and to despise somewhat their coarser but cheaper rivals of Manchester and Glasgow. But these exquisite productions have been created in satisfaction of the law of supply and demand. The rajahs and princes of India, swathed in riches and steeped in luxurious pleasures, require in their enervating climate the softest and most delicate tissues for themselves as well as for their Zenana.

The use of the very finest muslins is restricted to members of a royal house. In a country which contains two prominent classes—princes and peasants—the former will naturally prevail, and we find throughout India that there has been a demand for the choicest and most beautiful specimens of manufacturing art, for the gratification of the powerful and the rich. The chief thought of the dependent has been to produce the most luxurious and most exquisite fabric for the prince and his favourites. The intelligence and dexterity of the spinner and weaver are taxed to the utmost strength to supply their wishes or anticipate their wants, and the reward is frequently as lavish as it is generous; and in proof of the estimation in which the art of weaving is held, Mr. Redgrave states that the Hindoo weaver ranks above all other mechanics, and next below the scribe. The delicacy and fineness of the Dacca muslins are not easy to describe. In the imaginative language of the East, they have been called "webs of woven wind;" and it has been stated that when laid upon the grass to be bleached, and the dew is upon it, it cannot be discerned. That this latter description is not overdrawn, we may gather from a circumstance which is related to have taken place at the court of Arungzebe. He is said to have chidden his daughter for appearing before him too thinly clad, when she replied to him that she was clothed in nine folds of raiment. She might have added that her garment contained a filament of cotton which, if produced, would measure upwards of forty miles. And a Persian ambassador, upon returning from India to his own country, is said to have presented his Sovereign with a cocoa-nut containing a piece of India muslin for a turban 30 yards in length, which when expanded in the air could hardly be felt.

"Reckoning the dress of the daughter of Arungzebe as containing 20 square yards, and that four miles of yarn could be spun by an expert spinner in India from 180 grains of cotton, her dress would weigh about four ounces, and contain forty miles of yarn; and then, calculating according to the English method of determining the fineness, or, as it is technically called, the counts, or numbers, of yarn, by reckoning so many hanks or skeins, of 840 yards each skein, to a ℔ weight, it would appear that her dress was made of about 320's, *i. e.*, 320 hanks of cotton yarn, each measuring 840 yards=160 miles of yarn, which would weigh 1℔. But to spin 300's is no marvel in Britain; 700's are constantly spun for the manufacture of lace, *i. e.*, a pound of yarn of that degree of fineness will measure upwards of 334 miles in length. The Messrs. Thos. Houldsworth & Co., of Manchester, who probably, spin the finest yarn in England, spun for the Great Exhibition of 1851 specimens in short lengths of 2,150's=1,026 miles to the pound weight, and the estimate is that the fibre of the raw cotton from which this yarn was spun would average 8,000's *i. e.*, it would require 8,000 hanks of a single fibre of the raw cotton, each hank measuring 850 yards, to weigh one pound. It may be true that the delicate fingers and sensitive organism of the Hindoo girl may enable her to manipulate the fibre of the cotton in spinning, with a certain degree of elasticity of which the spinning machine is incapable, but in the one quality of degree of fineness, we compete successfully with the Hindoo."

"It has been well said by Lord Palmerston, that dirt is only to be condemned when it is in the wrong place. Now, a factory is certainly not the place for the accumulation of dirt, nor is the stream which flows in its vicinity the proper place for its reception. All offensive and dirty matters used to be freely discharged into the nearest stream, but now the dirty and greasy washings of factories, and herein I allude chiefly to woollen and worsted factories, are conducted to a tank, and by a very simple process the watery particles are discharged, and the residuum is reconverted into a fatty substance, largely used for candles and the manufacture of soap. In one establishment alone I am assured that a profit of £800 a year, after paying a rent of £200 to some neighbouring factories for their refuse, is made by this conversion to useful purposes of the dirt which formerly polluted the stream and neighbourhood."

It has been found that old materials form very good substitutes for new. The bits of raw cotton which do not pass through the machines, the ends of rovings and yarn, the flaws, which are broken off, are all carefully preserved, and undergo several modes of preparation by which they become serviceable for various purposes. It is the same with wool, with flax, and with silk—but the chief utilisation of old materials is the manufacture of new coats out of old. A Polish Jew, or Italian beggar, is generally considered one of the dirtiest objects with which we can come in contact, yet it is not impossible that some of us may, at this moment, happily unconscious of our fate, be wearing some portion of the cast-off habiliments of a Polish Jew. Coats, trowsers, &c., after having been well worn in England, are shipped off for the German ports, and after having been distributed where most in request, and thoroughly used up as garments, they return to us as woollen rags. They are sorted into qualities, and they then go through a machine called a devil, which tears up the bits of cloth and delivers them out as wool, which undergoes again the various processes of carding, spinning, &c., and being mixed with new wool, again becomes cloth.

It is calculated that at least 45,000,000 ℔s. of woollen rags are annually consumed, which is about one-fifth of the whole of the material, new or old, now used in the manufacture of woollen cloth. Twenty-five years ago the price of the woollen rags averaged about £4 4s. per ton, but the present demand for them has raised that price to £44 per ton. When these rags were first introduced, and for some years afterwards, they were only of use if they contained nothing but wool originally. But the demand became so pressing, that the rags of fabrics made of

cotton and wool, and of cotton and worsted, are no longer rejected. They undergo a process called "extraction," by which the cotton is destroyed, and the woollen fibre is preserved and utilised. Although rags are very generally used in woollen factories, they are principally manufactured at Dewsbury, Batley, and the neighbourhood near Leeds, in which it is estimated that from 7,000,000 to 8,000,000 of yards of cloth are annually manufactured, of the value of £1,500,000.

The amount of material produced by the looms of the United Kingdom is almost incredible. The cotton yarn annually spun in that country, reckoning it to be of an average size, would reach 600,000 times round the earth, and our looms produce annually 3,000,000 yards of calico.

The cotton factories contain one-half of the cotton spindles of the rest of the world, and can produce cotton better and cheaper than in any other country. They spin daily 50,000,000 of miles of yarn, from which our looms weave daily 10,000,000 yards of calico or other goods.

"Can it be wondered at that there is a party of politicans called the "Manchester School." It is common for us to condemn those who seek to maintain class interests, but do not all endeavour to support their own class? the army and navy—landowners—coal-owners—ironmasters, all keep their own interests before them. The manufacturers do the same. They have wealth, they have intelligence, and the 6,000 or 7,000 masters have the responsibility of being in the aggregate the mainstay of nearly one-fifth of the country."

There were consumed in 1860 not less than one thousand million ℔s. of cotton, and the maximum extent of the manufactory of textile fabric reached £150,000,000 stg. At least 75 per cent. of the superior descriptions of paper are now made from the refuse of the Cotton Mills.

The statistics supplied by Mr. P. L. Simmonds who has had lately under his care the preparation of new editions of "Ure's History of the Cotton Manufacture" and other commercial works, go far beyond those given in the foregoing paragraphs, which were completed up to the year 1856. The position of the Textile Industry in 1850, Mr. Simmonds represents to us as follows:—

Textile Industry.	Estimated value of Goods Manufactured	Declared value of Quantity Exported.	Estimated Quantity consumed in the U. Kingdom. Value.
	£	£	£
Cotton	104,000,000	52,000,000	52,000,000
Wool and Worsted	32,000,000	16,000,000	16,000,000
Flax	18,600,000	6,600,000	12,000,000
Silk	18,400,000	2,400,000	16,000,000
	173,000,000	77,000,000	96,000,000

In explanation of this table it is stated in relation to cotton that the exports have nearly doubled in the last ten years. In 1850 we shipped £28,400,000; in 1855, £34,800,000; and in 1860, £52,000,000. The imports of raw cotton have also doubled in the same period. In 1850 we received 663½ million pounds; in 1855, 892 million pounds, and in 1860, 1,391 million pounds. Passing next to wool and worsted—Mr. Simmonds calculated it at 200,000,-000℔s., but these opinions were conjectural. The nett imports of foreign and colonial wool (less the re-exports) were, in 1850, 64,000,000℔s.; in 1855, 70,000,000℔s.; and in 1860, 118,000,000℔s. The exports of woollen manufactures, including yarn, &c., had been to the value of £9,000,000 in 1850, £7,700,000 in 1855 (a year of war), and £16,-000,000 in 1860. Pass next to the linen trade. There were more than 100,000 acres under culture with flax in Ireland, and at least £12,000,000 of capital employed in the trade. Our foreign supplies of flax are declining, for in 1850 we received 1,822,918 cwts., while in each of the past years we had received less than 1½ million cwts. But there is a fibrous material brought in and largely worked up now at Dundee with flax, which ought not to be lost sight of, namely jute, of which we imported upwards of 1,000,000 cwts. in 1859, a quadruple increase since 1853. Our exports of linen manufactures have not increased very rapidly; the value of the shipments in 1850 and 1855, was £5,000,000, and in 1860, £6,600,000, but the bulk of this manufacture was used at home, and was fully double the value of that exported. The last textile for notice is silk; and here, too, the principal quantity made is used at home. The value of the exports stood in the following order:—1850, £1,250 000; 1855, £1,523,000; 1860, £2,400,000. The total value, from the data and estimates submitted by Mr. Simmonds, showed an increase of fully 50 per cent. upon the returns submitted by Mr. Redgrave, and, even making all reasonable deductions for error, they would give, it was thought, a fairer estimate of the magnitude of the trade and of the present aggregate value of the textile industries of the kingdom. The utilisation of waste substances, the collection of the blowings and droppings, the recovered grease in the wool-factories, the re-conversion of old rags and mixed fabrics, &c.; these have risen into such importance that woollen rags, at one time worth only £4, now fetched £40 per ton. The use of these has been stigmatised as a fraud upon the consumers, and a disgrace to the manufacturers and to the country. But, in truth, the reconversion of old wool is a matter of necessity, arising from the dearth of raw material and the demand for cheap goods.

CATALOGUE OF THE ECONOMIC MINERALS OF CANADA.*

Metals and their Ores.

Magnetic Iron Ore.—Marmora, four localities; Madoc, four localities; South Sherbrooke, Bedford, Hull, three localities; Portage du Fort.

Specular Iron Ore.—Wallace Mine (Lake Huron,) MacNab, St. Arnaud, Sutton, three localities; Brome, three localities, Bolton.

Limonite (*Bog Ore.*)—Middletown, Charlotteville, Walsingham, Gwillimbury West, Fitzroy, Eardley, March, Hull, Templeton, Vaudreuil, St. Maurice, Champlain, Batiscan, Ste. Anne, Portneuf, Nicolet, Stanbridge, Simpson, Ireland, Lauzon, St. Vallier.

Titaniferous Iron.—St. Urbain (Baie St. Paul,) Vaudreuil (Beauce.)

Sulphuret of Zinc (*Blende.*)—Prince's Mine and Mamainse (Lake Superior).

Sulphuret of Lead (*Galena.*)—Fitzroy, Landsdowne, Ramsay, Bedford, Bastard, la Petite Nation, Anse des Sauvages, and Anse du Petit Gaspè, Maimanse.

Copper.—St. Ignace and Michipicoten Islands (Lake Superior,) St. Henri, *native copper*. Prince's Mine (Lake Superior,) *sulphuret of copper*. Mica Bay and Maimanse (Lake Superior) *sulphuret variegated copper and copper pyrites*. Bruce's Mine (Lake Huron,) Root River, Echo Lake and Wallace Mine (Lake Huron,) *copper pyrites*. Inverness and Leeds, *variegated copper*. Upton, *argentiferous copper pyrites*. Ascot, *copper pyrites containing gold and silver*.

Nickel.—Michipicoten (Lake Superior,) *arsenical nickel, with a hydrated silicate of nickel*. Wallace Mine (Lake Huron,) *sulpharseniuret of nickel*. Dailleboût Berthier, *nickeliferous pyrites*. Ham and Bolton, in small quantities, associated with chromic iron; the nickel in most of these different localities is associated with a little cobalt.

Silver. — St. Ignace and Michipicoten Islands (Lake Superior,) *native silver with native copper*. Prince's Mine (Lake Superior,) *native silver with sulphuret of silver*.

Gold.—Seigniory of Vaudreuil, Beauce, on the Rivers Guillaume, Lessard, Bras, Touffe des Pins, and du Lac. Seigniory of Aubert de Lisle. Rivers Famine and du Loup. Aubert-Gallion, Poses's Stream, and the River Metgermet. All these localities in the county of Beauce afford native gold in the alluvial sands. This auriferous region has an area of 10,000 square miles, and the precious metal has been found at Melbourne, Dudswell, Sherbrooke, and many other localities in the valleys of the St. Francis and the Chaudière. Native gold is also found in small quantities in Leeds, in a vein with specular iron, and at Vaudreuil, Beauce, with blende and pyrites. These sulphurets are both auriferous, and the copper pyrites of Ascot also contain a small proportion of gold. The native silver of Prince's Mine likewise contains traces of gold.

Non-Metallic Minerals.

Uranium.—The yellow oxyd of uranium is found in small quantities with the magnetic iron of Madoc.

Chromium.—Bolton and Ham are localities of chromic iron.

Cobalt.—At Prince's Mine, Lake Superior, *arseniate of cobalt* and associated with nickel in the localities mentioned above.

Manganese.—Bolton, Stanstead, Tring, Aubert-Gallion, Ste. Marie, Beauce, Ste. Anne, *earthy per-oxyd.*

Iron pyrites.—Clarendon, Terrebonne, Lanoraie, Garthsby.

Graphite.—Grenville, Fitzroy.

Dolomite.—Lake Mazinaw, North Sherbrooke Drummond, St. Armand, Dunham, Sutton, Brome Ely, Durham, Melbourne, Kingsey, Shipton, Chester, Halifax, Inverness, Leeds, St. Giles, Ste. Marie, Saint Joseph.

Carbonate of Magnesia.—Sutton, Bolton.

Sulphate of Baryta.—Bathurst, Macnab, Landsdowne, and many localities on Lake Superior.

Iron Ochres.—St. Nicholas, Ste. Anne de Montmorency, Champlain, Waltham, Mansfield, Durham.

Steatite.—Sutton, Bolton, Melbourne, Ireland, Potton, Vaudreuil, Beauce, Broughton, Elzevir. The steatite of the last four localities is employed as a refractory stone, and that of Stanstead and of Leeds is ground and employed as a paint.

Lithographic Stone.—Marmora, Rama, late Couchiching.

Agates.—Isle St. Ignace, Michipicoten, and Thunder Bay (Lake Superior) Gaspé.

Jasper.—Great Rivière Ouelle, Gaspé.

Labrador felspar.—Mille Isles, Drummond and many other localities.

Aventurine.—Burgess.

Hyacinthe.—Grenville.

Corundum.—Burgess.

Amethyst.—Spar Island, and many other localities on Lake Superior.

Jet.—Montreal.

Quartzose Sandstone.—For the Manufacture of glass, Cayuga, Dunn, Vaudreuil, Isle Perrot, Beauharnois, and many localities on the north shore of Lake Huron.—The sandstone of St. Maurice is employed as a fire-stone for iron furnaces.

Retinite and Basalt.—For the fabrication of black glass: many localities on Lake Huron and Superior.

Gypsum.—Dumfries, Brantford, Oneida, Seneca, Cayuga, &c., the localities are very numerous.

Shell Marl.—Calumet, Clarendon, North-Gwillimbury, Bromley, MacNab, Nepean, Gloucester, Argenteuil, Hawkesbury, Vaudreuil, St. Benoit, Ste. Thérèse, St. Armand, Stanstead, St. Hyacinthe, Montreal, New Carlisle, (Gaspé.)

Phosphate of Lime.—Burgess, Hull, Calumet, Ottawa.

Millstones.—Several kinds of stone, more or less adapted to the purpose, are employed in Canada for the fabrication of millstones. The best is a corneous quartzite which accompanies the serpentine of the Eastern Townships, and has been wrought at Bolton.

A silicious conglomerate which serves to make millstones is found at Vaudreuil, at the Cascades, Ham and Port Daniel. We may mention also for this purpose the granites of Stanstead, Barnston, Barford, Hereford, Ditton, Marston, Stafford, Weedon and Vandreuil, Beauce, the granite millstones of Vandreuil are much esteemed. The pseudo-granites and diorites of the mountains of Ste. Thérèse, Rouville, Rougemont, Shefford, Yamaska and Brome are also sometimes employed to make millstones.

* From the Report of the International Exhibition at Paris, 1855.

Grindstones.—A sandstone, known as the gray-band, and found at the base of the upper silurian of Western Canada in many localities is employed for the fabrication of grindstones. The Potsdam sandstone and a sandstone from Gaspé basin are also employed for the same purpose.

Whetstones.—Madoc, Marmora, Lake Mazinaw, Fitzroy, Potton, Stanstead, Hartley, Bolton, Shipton, Marston.

Tripoli.—Laval, Lanoraie.

Building Materials.

Granites.—Large masses of a very beautiful intrusive granite are found in many of the townships of the East. Among other localities we may cite Stanstead, Barnston, Hereford, Marston, Megantic mountains, Weedon, Winslow, Stafford, and Lambton. The diorites of the mountains of the Ste. Thérèse, Rouville, Rougemount, Yamaska, Shefford, and Brome, furnish also good building stones.

Sandstone.—A beautiful variety of yellowish-white sandstone occurs at Niagara, Queenstown, Barton, Hamilton, Flamboro' West, Nelson, Nassagaweya, Esquesing, Nottawassaga, and Cayuga. Other localities are Rigaud, Vaudreuil, Ile Perrot, St. Eustache, Terrebonne, Beauharnois, St. Maurice, Lac des Allumettes, and Fitzroy.

Calcareous Sandstone.—Brockville, Ottawa, and a great many places on the Ottawa River, St. Nicolas (Lauzon), Cape Rouge Malbaie.

Limestones.—Malden, Manitoulin and St. Joseph's Islands, Cape Hurd, Cabot's Head, Sydenham, Euphrasia, Nottawassaga, Mono, Esquesing, Nelson, Ancaster, Thorold, Matchedash Bay, Orillia, Rama, Mara, Marmora, Madoc, Belleville, Kingston, Macnab, Ottawa, Plantagenet, Hawkesbury, Cornwall, Isle Bizard, Isle de Beauharnois, Caughnawaga, Montreal, Isle Jésus, Terrebonne, Philipsburg, St. Dominique, Grondines. Deschambault, Beauport, Baie St. Paul, Malbaie, Upton, Acton, Wickham, Magoon's Point, Stanstead, Hartley, Dudswell, Temiscouata Gaspé, Port Daniel, Richmond, Anticosti.

Hydraulic Limestones.—Point Douglas, (Lake Huron,) Paris, Cayuga, Thorold, Kingston, Loughboro', Hull, Quebec.

Roofing Slates.—Kingsey, Halifax, Lambton, Melbourne, Westbury, Rivière du Loup.

Flagging Stones.——Toronto, Etobicoke, River Credit, York, Temiscaming, Bagot, Horton, Clarendon, Sutton, Potton, Stanstead, Inverness, Port Daniel.

Clays.—Clays suitable for the fabrication of red bricks, tiles and coarse pottery, are everywhere found through the valleys of the St. Lawrence, Richelieu and Ottawa. Clays, for the manufacture of white bricks are met with at London, Toronto, Cobourg, and Peterborough.

Moulding Sand.—Augusta near Prescott, Montreal, Acadie, Stanstead.

Fuller's Earth.—Nassagaweya.

Marbles.—*White.*—Lake Mazinaw and Philipsburg.

Black.—Cornwall, Philipsburg.

Red.—St. Lin.

Brown.—Pakenham.

Yellow and Black.—Several varieties at Dudswell.

Grey and variegated.—Macnab, Philipsburg, St. Dominique, Montreal.

Green.—Serpentines affording several beautiful varieties of marble occur at Grenville, and along a range of 150 miles in the Eastern Townships. Among other localities we may mention Stukely, Brompton, Oxford and Vaudreuil—Beauce.

COMBUSTIBLES, &c.,

Peat.——Humberstone, Wainsfleet, Westmeath, Beckwith, Goulbourn, Gloucester, Cumberland, Clarence, Plantagenet, Alfred, Caledonia, L'Orignal, Osnabruck, Finch, Winchester, Roxburg, Longueuil, St. Hyacinthe, Monnoir, the Seigniory of Rivière du Loup, Riviere Ouelle, Macnider.

Petroleum.—Mosa and many localities on the Thames, River St. Jean and Ruisseau-Argenté. (Gaspé.)

Asphaltum.—Enniskillen.

CONDITION OF INDUSTRY IN FOREIGN COUNTRIES.

Hungary.

Bounded on the west by Germany; on the south and east by the tributary Turkish Provinces of Bosnia, Servia, Wallachia, and Moldavia; and on the north by the Carpathian mountains—Hungary forms nearly a square of 400 miles in each direction, comprising, with all its appendant States, an area of 133,000 square miles.

The Carpathians sweep nearly in a semi-circle round the northern and eastern border of Hungary. Several connected chains penetrate into the heart of the country, of which the most elevated are those of Tatra and Matra. The Julian Alps, and the mountains of the Banat, on the southern border, render a great part of the country very hilly. On the other hand, there are plains of enormous extent, such as that to the east of the Danube, watered by the Theiss, which covers a space of upwards of 22,000 square miles; and another, to the west of that river, reaching to the borders of Styria.

The rivers of Hungary are very important. The Danube rolls through it, chiefly from north to south. The Drave and the Save, from the east, bring to it all the waters of the great Alpine border of Southern Germany. The Theiss, after collecting nearly all the streams which flow from the Carpathians, falls in from the east, near the southern frontier. The Maros is the greatest tributary of the Theiss; and the Gran and the Waag are considerable streams, which flow into the Danube itself.

Only two of the lakes of Hungary are large—the Platten, or Balaton which receives the waters of nine streams, and the Neusiedler, the water of which is salt.

The mineral wealth of Hungary is very abundant. Gold and silver are found in great abundance at Schemnitz, Kremnitz, Schmöllnitz, &c., in some parts of Transylvania, and also at Ruszberg and Orawicza in the Banat. Gold-dust is washed from the Rivers Danube, Koros, and Maros, the latter of which yielded a lump weighing above 22 ounces, which is preserved in the National Museum. The mines of Hungary yield also large quantities of copper, iron, lead, coal, and salt; and amongst its treasures may be enumerated quicksilver, arsenic, antimony, sulphur, soda, saltpetre, marbles, porcelain clay, millstone, porphy-

ries; and stones for artistic purposes are also found in abundance.

Population.

According to the latest census, taken in 1857, the population of Hungary with the Banat amounts to 9,679,243 souls; that of Crotia and Slavonia to 865,403 souls; and that of Transylvania to 2,180,121 souls.

Means of Communication.

Several lines of railway are already completed and in use.

The ordinary roads for communication cannot be said to be in a satisfactory condition. The best are to be found in the County of Wiesselburg, and, generally, in Upper Hungary, while in Lower Hungary they are very bad, materials for their construction being deficient. Those leading to the great seats of trade on the Danube are generally well maintained. The ordinary cross-roads are all but impassable in bad weather.

The most important communication by water is on the Danube and the Theiss, both for steam and ordinary navigation, after which follow the Rivers Drave and Maros. The canals, especially the Bega, are of great importance in the corn-trade. The lesser rivers, in their present condition, can be considered as navigable only for rafts; but it is thought possible, by proper regulation, to render some of them such as the Waag, the Gran, and the Koros, of great importance to trade.

Markets.

Hungary, with the Banat, has 632 market-places, at all of which fairs are held three or four times in the year; and it is computed that on each day of the year no less than eight markets are held in the country.

The four annual fairs of Pesth are known to the whole commercial world, and may be said to possess European importance. Next, after them, rank the fairs of Debreczin.

Agricultural Production.

According to the statistics furnished by Hain, Hungary produces annually:—

	*Austrian measures.**
Wheat	11,186,000
Rye	13,150,000
Maize	11,530,000
Barley	14,425,000
Oats	21,912,000
Buckwheat, rice, &c	1,250,000
Vegetables	1,500,000

In the northern districts of Hungary, rye, oats, and potatoes are the chief objects of agricultural production, being also the staple articles of food; while in Lower Hungary, and especially in the Banat, and also in the Counties of Stuhlweissenburg and and Eisenburg, wheat is almost exclusively cultivated. In all the other parts of the country, the species of grain mainly cultivated is rye, which the peasants chiefly use to prepare their ordinary bread. In some of the northern districts bread is generally made from oats and potatoes, while the populations of Rouman race live almost entirely on maize.

Rape-seed is produced on the plains of Hungary; *flax* is chiefly grown in Upper Hungary; and *hemp* in the southern counties, generally for home consumption.

* An Austrian measure slightly exceeds two English bushels.

Turnips are cultivated as food for cattle, and *beet-root* for the use of sugar-factories. The cultivation of other kinds of fodder for cattle is greatly neglected.

Potatoes are produced throughout the country, partly for food, and partly for the use of distilleries. Of late, however, many of these have ceased to work, owing, in some measure, to the increased taxes levied upon spirits and brandy, but chiefly on account of deficient capital.

Hops are but little cultivated, Those generally used are imported from Bohemia.

Tobacco.—The production of this plant has greatly diminished since it became an object of State monopoly.

Timber.—The value of the "forest" productions of Hungary is estimated at 40,743,000 florins. The oak forests are reputed to consist of two kinds: the red, a quick-growing, soft wood, of little use, except for firing; and the white—a firm, lasting timber, said to be well adapted for ship-building.

Wines.—The annual production of wine in Hungary is popularly estimated at 20,000,000 eimers, but statistically it is computed at 17,740,680 eimers, the value of which, is 66,037,000 florins, while the value of the wine produced in the Banat and Transylvania is 17,541,000 florins.

Hungarian wines may be divided into: 1. Liqueur wines; 2. Good dry table wines; 3. Effervescent wines; and 4. Wines of consumption. The liqueur wines, of which that made in the neighbourhood of Tokay is the most celebrated, are not to be considered as the finest samples of what the country produces. It is amongst the good dry table-wines that delicacy of flavour and aroma is found in perfection. Both white and red wines of the three classes above mentioned are produced in different districts, and not unfrequently in the same. Effervescent wines, known as Hungarian "Champagne," are almost exclusively made in the Pressburg district. The sweet wines, commonly called "Ausbruch," which resemble those known as "straw" wines in France, are the result of a course of manipulation which is adopted, with little modification, in all the best districts of Hungary. The fruit is not, as in France, gathered and laid or hung out to shrivel, but the vintage is deferred until a greater part of the fruit has become dead ripe and partly shrivelled on the vines. The fruit that is in this state is carefully selected during the vintage from that which has only reached ordinary maturity; the berries are hand-picked from the stalks, all that are rotten or damaged being excluded, and are reduced to a smooth mash or jelly by treading, when a sufficient quantity of the best must of unwithered fruit is added to render the whole liquid; the liquor is then frequently stirred to set the pips free, which are skimmed off as they rise to the surface. As soon as fermentation begins, this mash is passed through the press, and the liquor is collected in seasoned casks to ferment. The fermentation is slow, the wine not clearing itself generally in less than six months, and, in some instances, owing to peculiarities of season, not fining itself sufficiently for use under three years. About 400lb. weight of shrivelled fruit, and nearly 15 gallons of fresh must, are required to produce a fass (about 33 gallons) of really good Ausbruch. Next to Tokay, which is white, the most celebrated Ausbruchs are those of Ménesh (Ménes) which are mostly red; those of Rust and Oedenburg, which are white and red; those of Erlau, which are red, and

those of St. Georgen, near Pressburg, which are white.

Of the great majority of the red and white dry table wines, it may be said that they possess considerable body, and that they are endowed with fine flavour and very delicate aroma. It is the opinion of a highly intelligent English traveller, whose notes on the vineyards of Hungary have been printed anonymously, and are full of interesting details,—that these wines are, as a rule, drier than French wines, more mellow than those of the Rhine, and more piquant than the choicest of Spain.

Wool.—There are no certain data as to the production of sheep-wool in Hungary and the adjacent States, but it may be computed as averaging annually about 200,000 cwt.

Cattle and Swine.—The best specimens of cattle are found in the plains of Lower Hungary, those of Upper Hungary being of small size. Nine hundred thousand oxen are annually reared in Hungary, Croatia, and Salvonia, and they form, together with swine, an important article in the export trade with the neighbouring States. There is also an extensive trade in bristles, which are said to be superior to those of Russia.

Skins, Sheep and Lamb.—The annual exportation of these articles is computed at 2,500,000 pieces, of which a considerable quantity is taken by two trading houses at Frankfort. The English importation of undressed lamb-skins from Austria amounted in 1858 to 324,444 pieces.

Among minor articles of trade are gall-nuts, honey and wax, linen rags, feathers, leather, &c.

The prevailing system of farming throughout the country is of the very rudest description. Wooden ploughs are used to turn the soil, and the operation of threshing is accomplished by the tramp of horses' feet. Primitive precepts accompany primitive art, and it is held shameful in Hungary "to muzzle the beast that treadeth out the corn."

There are some industrial enterprizes in connection with agriculture, but they cannot be said to be in a flourishing condition. Amongst them may be mentioned, distilleries of spirit from grain, potatoes, beet-root, &c.; beer breweries; sugar refineries and factories; and flour mills. These enterprises suffer from severity of taxation, and languish generally from want of capital. Indeed, in every department of husbandry, the want of capital is most severely felt in Hungary. Capital applied to the land itself; capital employed in the manufacture of implements; capital expended on the improvement and extension of the means of communication, would render Hungary one of the most flourishing agricultural countries in Europe.

Manufactures,

in the sense understood in England, can scarcely be said to exist in Hungary. There are, however, coarse domestic fabrics of linen and woollen for home consumption. Of late years, too, some factories have been established in the country, of which the following are the principal:—

1. The cotton-printing and blue-dyeing factory of the Brothers Goldberger, in Buda (Alt-Ofen).
2. The factory of the same kind, of Spitzen, in the same city.
3. The wood cutting and sawing mills in Pesth.
4. The China factory of Fischer, in Herend, in the county of Veszprim.
5. The cloth factory in Zai-Ugrocz, belonging to Count Zay.
6. The cloth factory of Gáes, belonging to a Joint Stock Company.

There are also some paper and chemical factories, and there are steam mills in Sneged, Snolnok, Buda, Pesth, &c., in which latter city is a factory of agricultural implements.

ON THE CHEMICAL HISTORY OF A CANDLE.

BY M. FARADAY, D.C.L., F.R.S.

From the Chemical News, Jan. 19th 1861.

LECTURE III.—PRODUCTS: WATER FROM THE COMBUSTION—NATURE OF WATER—A COMPOUND—HYDROGEN.

I dare say you well remember that when we parted we had just mentioned the word "products" from the candle. For when a candle burns we found we were able, by nice adjustment, to get various products from it. There was one substance which was not obtained when the candle was burning properly, which was charcoal or smoke, and there was some other substance that went upwards from the flame which did not appear as smoke, but took some other form and made part of that general current which, ascending from the candle upwards, becomes invisible and escapes. There were also other products to mention. You remember that in that rising current having its origin at the candle, we found that a part was condensible against a cold spoon, or against a clean plate, or any other cold thing, and part was incondensible.

We will first take the condensible part and examine it, and, strange to say, we find that that part of the product is just water—nothing but water. I last time spoke of it incidentally, merely saying that water was produced among the condensible products of the candle; but, to-day, I wish to draw your attention to water that we may examine it carefully, especially in relation to this subject, and also with respect to its general existence on the surface of the globe.

Now, having previously arranged an experiment for the purpose of condensing water from the products of the candle, my next point will be to show you this water; and perhaps one of the best means that I can adopt for showing its presence to so many at once, is to exhibit a very visible action of water, and then to apply that test to what is collected as a drop at the bottom of that vessel. I have here a chemical substance discovered by Sir Humphrey Davy, which has a very energetic action upon water, which I shall use as a test of the presence of water. If I take a little piece of it—it is called potassium, as coming from potash—if I take a little piece of it, and throw it in that basin, you see how it shows the presence of water by lighting up and floating about, burning. I am now going to take away the candle which has been burning underneath the vessel containing ice and salt, and you see a drop of water—a condensed product of the candle—hanging from the under surface of the dish. I will show you that potassium has the same action upon it as upon the water in that basin in the experiment we have just tried. See! it takes fire and burns in just the same manner. I will take another drop upon this glass slab, and when I put the potassium on to it you see at once, from its taking fire, that there is water present. Now, that water was produced by the candle,

In the same manner, if I put this spirit-lamp under that jar, you will soon see the latter become damp from the dew which is deposited upon it—that dew being the result of combustion; and I have no doubt you will shortly see, by the drops of water which fall upon the paper below, that there is a good deal of water produced from the combustion of the lamp. I will let it remain, and you can afterwards see how much water has been collected. So, if I take a gas-lamp, and put any cooling arrangement over it, I shall get water,—water being likewise produced from the combustion of gas. Here, in this bottle, is a quantity of water—perfectly pure, distilled water, produced from the combustion of a gas-lamp—in no point different from the water that you distil from the river, or ocean, or spring, but exactly the same thing. Water is one individual thing, it never changes. We can add to it by careful adjustment, for a little while, or we can take it apart and get other things from it, but water, as water, remains always the same, either in a solid, liquid, or fluid state. Here again [holding another bottle] is some water produced by the combustion of an oil-lamp. A pint of oil, when burnt fairly and properly, produces rather more than a pint of water. Here, again, is some water, produced by a rather long experiment, from a wax candle. And so we can go on with almost all combustible substances, and find that if they burn with a flame, as a candle, they produce water. You may make these experiments yourselves; the head of a poker is a very good thing to try with, and if it remains cold long enough over the candle, you may get water condensed in drops on it; or a spoon, or ladle, or anything else may be used, provided it be clean, and can carry off the heat, and so condense the water.

And now—to go into the history of this wonderful production of water from combustibles, and by combustion,—I must first of all tell you that this water may exist in different conditions, and although you may now be acquainted with all its forms, they still require us to give a little attention to them for the present; so that we may perceive how the water, whilst it goes through its Protean changes, is entirely and absolutely the same thing, whether it is produced from a candle by combustion, or from the rivers or ocean.

First of all, water when at the coldest is ice. Now we philosophers,—I hope that I may class you and myself together in this case,—speak of water as water, whether it be in its solid, or liquid, or gaseous state—we speak of it chemically as water. Water is a thing compounded of two substances, one of which we have derived from the candle; and the other, which we shall find elsewhere. Water may occur as ice; and you have had most excellent opportunities lately of seeing this. Ice changes back into water; and on our last Sabbath we had a strong instance of this change, by the sad catastrophe which occurred in our own house, as well as in the houses of many of you. Ice changes back into water when the temperature is raised: water also changes into steam when it is warmed enough. The water which we have here before us as ice, is in its densest state, and although it changes in weight, in condition, in form, and in many other qualities, it still is water; and whether we alter it into ice by cooling, or whether we change it into steam by heat, it increases in volume,—in the one case very strangely and powerfully, and in the other case very largely, and strangely, and wonderfully. For instance, I will now take this tin cylinder, and pour a little water into it, and seeing how much water I pour in, you may easily estimate for yourselves how high it will rise in the vessel: it will cover the bottom about two inches. I am now about to convert the water into steam, for the purpose of showing to you the different volumes which water occupies in its different states of water and steam.

Let us now take the case of water changing into ice; we can effect that by cooling it in a mixture of salt and pounded ice,—and I shall do so to show you the expansion of water into a thing of larger bulk when it is so changed. These bottles [holding one] are made of strong cast-iron, very strong and very thick—I suppose they are the third of an inch in thickness; they are very carefully filled with water, so as to exclude all air, and then they are screwed down tight. We shall see that when we freeze the water in these iron vessels, they will not be able to hold the ice, and the expansion within them will break them in pieces as these [pointing to some fragments] are broken which have been bottles of exactly the same kind. I am about to put these two bottles into that mixture of ice and salt, for the purpose of showing that when water becomes ice, it changes in volume in this extraordinary way.

In the meantime look at the change which has taken place in the water to which we have applied heat; it is loosing its fluid state. You may tell this by two or three circumstances. I have covered this glass flask—in which water is boiling—over with a watch-glass. Do you see what happens? It rattles away like a valve chattering, because the steam rising from the boiling water sends the valve up and down, and forces itself out, and so makes it clatter. You can very easily perceive that that flask is quite full of steam, or else it would not force its way out. You see also that the flask contains a substance very much larger than the water, for it fills the whole of the flask over and over again, and there it is blowing away into the air; and yet you cannot observe any great change in the bulk of the water, which shows you that its change of bulk is very great when it becomes steam.

I have put our iron bottles containing water into this freezing mixture that you may see what happens. No communication will take place, you observe, between the water in the bottles and the ice in the outer vessel. But there will be a conveyance of heat from the one to the other, and if we are successful—we are making our experiment in very great haste—I expect you will by-and-by, so soon as the cold has taken possession of the bottles and their contents, hear a pop on the occasion of the bursting of the one bottle or the other, and, when we come to examine the bottles, we shall find their contents masses of ice partly enclosed by the covering of iron which is too small for them, because the ice is larger in bulk than the water. You know very well that ice floats upon water; if a boy falls through a hole into the water, he tries to get on the ice again to float him up. Why does the ice float? Think of that, and philosophise. Because the ice is larger than the quantity of water which can produce it, and therefore the ice weighs the lightest and the water is the heaviest.

To return now to the action of heat on water. See what a stream of vapour is issuing from this tin vessel. You observe, we must have made it quite full of steam to have it sent out in that great quan-

tity. And now, as we can convert the water into steam by heat, we convert it back into liquid water by the application of cold. And if we take a glass, or any other cold thing, and hold it over this steam, see how soon it gets damp with water; it will condense it until the glass is warm—it condenses the water which is now running down the sides of it. I have here another experiment to show the condensation of water from a vaporous state back into a liquid state, in the same way as the vapour, one of the products of the candle, was condensed against the bottom of the dish and obtained in the form of water; and to show you how truly and thoroughly these changes take place, I shall take this tin flask, which is now full of steam, and I shall close the top. We shall see what takes place when we cause this water or steam to return back to the fluid state by pouring some cold water on the outside. [The Lecturer poured the cold water over the vessel, when it immediately collapsed.] You see what has happened. If I had closed the stopper and still kept the heat applied to it, it would have burst the vessel: yet, when then the steam returns to water, the vessel collapses, there being a vacuum produced inside by the condensation of the steam. I show you these changes for the purpose of pointing out that in all these occurrences there is nothing that changes the water into another thing; it still remains water, and so the vessel is obliged to give way and is blown inwards, as in the other case, by the further application of heat, it would have been blown outwards.

And what do you think the bulk of that water is when it assumes the vaporous condition? You see that cube [pointing]; it is a cubic foot. There, by its side is a cubic inch: it is square, exactly the same shape as the cubic foot, and that bulk of water [the cubic inch] will make that bulk [the cubic foot] of steam, and the application of cold will contract that large quantity of steam into that small quantity of water. [One of the iron bottles, burst at that moment.] Ah! There is one of our bottles burst, and here you see is is a crack down one side an eight of an inch in width. [The other now exploded sending the freezing mixture in all directions.] This other bottle is now broken; although the iron was nearly half-an-inch thick, the ice has burst it asunder. These changes always take place in water; they do not require to be always produced by artificial means, we only use them here because we want to produce a small winter round that little bottle instead of a large one. But if you go to Canada, or to the North, you will find the temperature there out of doors will do the same thing as has been done here by the freezing mixture.

To return to our quiet philosophy. We shall not in future be deceived, therefore by any changes that are produced in water. Water is the same everywhere, whether produced from the ocean or from the flame of the candle. Where then, is this water which we get from a candle? I must anticipate a little, and tell you. It evidently comes, as to part of it, from the candle, but is it within the candle beforehand? No. It is not in the candle; and it is not in the air round about the candle which is necessary for its combustion. It is neither in one nor the other but it comes from their conjoint action, a part from the candle, a part from the air; and this we have now to trace so that we may understand thoroughly what is the chemical history of a candle when we have it burning on our table. How shall we get at this? I myself know plenty of ways, but I want *you* to get at it from the association in your own minds of what I have already told you.

I think you can see a little in this way. We had just now the case of a substance which acted upon the water in the way that Sir Humphrey Davy showed us, and which I am now going to recall to your minds again by making an experiment upon that dish. It is a thing which we have to handle very carefully, for you see if I bring a little splash of water near this mass it sets fire to part of it; and if it set fire to a part, and there was free access of air, it would set fire to the whole. Now this is a metal—a beautiful and bright metal—which rapidly changes in the air, and as you know, rapidly changes in water. I will put a piece on the water, and you see it burns beautifully making a floating lamp, using the water in the place of air. Again, if we take a few iron filings or turnings and put them in water we find that they likewise change. They do not change so much as this potassium does, but they change somewhat in the same way, they become rusty, and show an action upon the water, though in a different degree of intensity, to what this beautiful metal does; but they act upon the water in the same manner generally as this potassium. I want you to unite these different facts in your minds. I have another metal here, and when we examined it with regard to the solid substance produced from combustion, we had an opportunity of seeing that it burnt; and I suppose, if I take a little strip of this zinc and put it over the candle, you will see something half way, as it were, between the combustion of potassium on the water, and the action of iron,—you see there is a sort of combustion. It has burnt, leaving a white ash or residum, and here also we find that that metal has a certain amount of action upon water.

By degrees we have learned how to modify the action of these different substances, and to make them tell us what we want to know. And now, first of all, I take iron. It is a common thing in all chemical reactions, where we get any result of this kind, to find that it is increased by the action of heat; and if we want to examine minutely and carefully the action of bodies one upon another, we often have to refer to the action of heat. Now you know, I think, that iron filings burn beautifully in the air; and I am about to show you an experiment of this kind, because it will impress upon you what I am going to say about iron in its action on water. If I take a flame which I make hollow,—you know why, because I want to get air to it and in it, and therefore I make it hollow,—if I take a few iron filings, and drop them into the flame, you see how well they burn. That combustion proceeds from the chemical action which is going on when we ignite those particles. And so we proceed to consider these different effects, and ascertain what iron will do when it meets with water. It will tell us the story so beautifully, so gradually and regularly, that I think it will please you very much.

I have here a furnace with a pipe going through it like an iron gun-barrel, and I have stuffed that barrel full of bright iron turnings, and the part that is so stuffed is put into the fire and is made red-hot. We can either send air through the barrel to come in contact with the iron, or else we can send steam from this little boiler at the end of the barrel. Here is a stop-cock which shuts out the steam from the barrel until we wish to admit it. There is some

water in these jars, which I have coloured blue so that you may see what happens. Now you know very well that any steam I might send through that barrel, if it went through into the water in the form of steam, would be condensed; for you have seen that steam cannot remain as steam if it be cooled down; you saw it here [pointing to the tin flask] crushing itself into a small bulk, and causing the flask containing it to collapse. So that if I were to send steam through that barrel it would be condensed — supposing the barrel were cold, — it is, therefore, heated to perform the experiment I am now about to show you. I am going to send the steam through the barrel in small quantities, and you shall judge for yourselves when you see it issue from the other end, whether it still remains steam. Steam is condensible into water, and when you lower the temperature of steam you convert it back into fluid water; but I have lowered the temperature of the gas which I have collected in this jar, by passing it through water after it has passed through the iron barrel, and still it does not change back into water. I will take another test and apply to this gas. (I hold the jar in an inverted position, or else I should lose my substance.) If I now apply a light to the mouth of the jar it ignites with a slight noise. That tells you that it is not steam, steam puts a fire out, it does not burn; but you saw that what I had in that jar burnt, We may obtain this substance equally from water produced from the candle flame as from any other source. When it is obtained by the action of the iron upon the aqueous vapour, it leaves the iron in a state very similar to that in which these filings were when they were burnt, It makes the iron heavier than it was before. So long as the iron remains in the tube and is heated, and is cooled again without the access of air or water, it does not change its in weight; but after having had this current of steam passed over it, it then comes out heavier than it was before, having taken something out of the steam, and having allowed something else to pass forth, which we see here. And now, as we have another jar full, I will show you something most interesting. It is a combustible gas; and I might at once take this jar and set fire to the contents, and show you that it is combustible; but I intend to show you more if I can. It is also a very light substance. Steam will condense; this body will rise in the air, and not condense. Suppose I take another glass jar, empty of all but air; if I examine it with a taper I shall find that it contains nothing but air. I will now take this jar full of the gas that I am speaking of, and deal with it as if it were a light body; I will hold both upside down, and turn the one up under the other; and that which contains, or did contain, the gas obtained from the steam, what does it contain now? You will find it now only contains air. But look! Here is the combustible substance [taking the other jar] which I have poured out of the one jar into the other. It still preserves its quality, and condition, and independence, and therefore is the more worthy of our consideration, as belonging to the products of a candle.

Now, this substance which we have just got by the action of iron on the steam or water, we can also get by means of those other things which you have already seen act so well upon the water. If I take a piece of potassium, and make the necessary arrangements, it will produce this gas; and if I take a piece of zinc, I find, when I come to examine it very carefully, that the main reason why this zinc cannot act upon the water continuously as the other metal does, is because the result of the action of the water envelopes the zinc in a kind of protecting coat. We have learned in consequence, that if we put into our vessel only the zinc and water, they, by themselves, do not give rise to much action; and we get no result. But suppose I proceed to dissolve off this varnish,—this encumbering substance,— which I can do by a little acid; the moment I do that I get the zinc acting upon the water, exactly as the iron did, but at the common temperature. The acid in no way is altered, except in its combination with the oxide of zinc which is produced. I have now poured the acid into the glass, and you would think I was applying heat to cause this boiling up. There is something coming off from the zinc very abundantly, which is not steam. There is a jar full of it; and you will find that I have exactly the same combustible substance remaining in the vessel, when I hold it upside down, that I produced from the experiment with the iron barrel. This is what we get from water, and this is the substance which is contained in the candle.

Let us connect these two points clearly and distinctly together. This is hydrogen—a body classed among those things which, in Chemistry, we call elements, because we can get nothing else out of them. A candle is not an elementary body, because we can get carbon out of it, we can get this hydrogen out of it, or at least out of the water which it supplies. And this gas has been so named hydrogen, because it is that element which, in association with another, generates water.[2] Mr. Anderson having now been able to get two or three jars of gas, we shall have a few experiments to make, and I want to show you the best way of making these experiments. I won't be afraid to show you, for I like you to make experments, if you will only make them with care and attention, and the assent of those around you. As we advance in Chemistry we are obliged to deal with substances which are rather injurious if in their wrong places; the acids, and heat, and combustible things we use, might do harm if used carelessly. If you want to make hydrogen, you can make it easily from bits of zinc, and sulphuric, or muriatic acid. Here is what in former times was called the "philosopher's candle." It is a little phial with a cork and a tube or pipe passing through it. And I am now putting a few little pieces of zinc into it. This little instrument I am going to apply to a useful purpose in our demonstrations, for I want to show you that you can prepare hydrogen, and make some experiments with it as you please, at your own homes. Let me here tell you why I am so careful to fill this phial nearly, and yet not quite, full. I do it because the evolved gas which, as you have seen, is very combustible, is explosive to a considerable extent, when mixed with air, and might lead to harm if you were to apply a light to the end of that pipe before all the air had been swept out of the space above the water. I am now about to put in the sulphuric acid. I have used very little zinc and more sulphuric acid and water because I want to keep it at work for some time. I, therefore, take care in this way to modify the proportions of the ingredients so that I may have a regular supply,—not too quick, and not too slow. Supposing I now take a glass and put it upside down over the end of the tube, because the hydrogen is light I expect that it will remain in that vessel a little

[2] ὑδωρ, "water," and γεννaω, "I generate."

while. We will now test the contents of our glass to see if there be hydrogen in it,—I think I am safe in saying we have caught some [applying a light]. There it is you see. I will now apply a light to the top of the tube. There is the hydrogen burning. There is our philosophical candle. It is a foolish, feeble sort of a flame, you may say, but it is so hot that scarcely any common flame gives out so much heat. There is the flame and the heat of the flame, and you see it goes on burning regularly, and I am now about to put that flame to burn under a certain arrangement in order that we may examine its results and make use of the information which we may thereby acquire. Inasmuch as the candle produces water, and this gas comes out of the water, Let us see what this gives us by the same process of combustion that the candle went through when it burnt in the atmosphere, and for that purpose I am going to put the lamp under this apparatus, in order to condense whatever may arise from the combustion within it. In the course of a short time you will see moisture appearing here in the cylinder, and you will get the water running down the side, and the water from this hydrogen flame will have absolutely the same effect upon all our tests, being obtained by the same general process as in the former case. This hydrogen is a very beautiful substance. It is so light that it carries things up ; it is far lighter than the atmosphere, and I daresay I can show you this by an experiment which, if you are very clever, some of you may even have skill enough to make. Here is our generator of hydrogen, and here are some soap-suds. I have an india-rubber tube connected with the hydrogen generator, and at the end of the tube is a tobacco pipe. I can thus put the pipe into the suds and blow bubbles by means of the hydrogen. You observe how the bubbles fall downwards when I blow them with my warm breath ; but notice the difference when I blow them with hydrogen. [The Lecturer here blew bubbles with hydrogen, which rose to the roof of the theatre.] It shows you how light a thing this must be in order to carry with it not merely the ordinary soap-bubble, but the larger portion of a drop hanging to the bottom of it. I can show its lightness in a better way than this ; larger bubbles than these may be so lifted up ; indeed, in former times balloons used to be filled with this gas. Mr. Anderson will fasten this tube on to our generator, and we shall have a stream of hydrogen here with which we can charge this balloon made of collodion. I need not even be very careful to get all the air out, for I know the power of this gas to carry it up. [Two collodion balloons were inflated and sent up, one being held by a string.] Here is another larger one made of thin membrane, which we will fill and send up ; you will see they will all remain floating about until the gas escapes.

What, then, are the comparative weights of these substances ? I have a table here which will show you the proportion which their weights bear to each other. I have taken a pint and a cubic foot as the measures, and have placed opposite to them the respective figures. A pint measure of this hydrogen weighs three quarters of our smallest weight, a grain, and a cubic foot weighs one-twelfth of an ounce ; whereas a pint of water weighs 8750 grains, and a cubic foot of water weighs almost 1000 ounces. You, therefore, see what a vast difference there is between the weight of a cubic foot of water and a cubic foot of hydrogen.

Hydrogen gives rise to no substance that can become solid, either during combustion or afterwards as a product of its combustion ; but when it burns it produces water only, and if we take a cold glass and put it over the flame of it, it becomes damp, and you have water produced immediately in abundance ; and nothing is produced by its combustion but the same water which which you have seen the flame of the candle produce. It is an important point for you to consider that this hydrogen is the only thing in the world that by combustion gives such a substance as this as its sole product

And now we must endeavour to find out some fresh proof of the general character and composition of this water, and for this purpose I will keep you a little longer, so that at our next meeting we may be better prepared for the subject. We have the power of arranging the zinc which you have seen acting upon the water by the assistance of an acid, in such a manner as to cause all the power to be evolved in the place where we require it. I have behind me a voltaic pile, and I am just about to show you at the end of this lecture, its character and power, that you may see what we shall have to deal with when we next meet. I hold here the extremities of the wires which transport the power from behind me, and which I shall use to act on the water.

We have previously seen what a power of combus- is possessed by the potassium, or the zinc, or the iron filings ; but none of them show such energy as this. [The Lecturer here made contact between the two terminal wires of the battery when a bright flash of light was produced.] This light is, in fact, produced by a forty-zinc power of burning, it is a power that I can carry about in my hands through these wires at pleasure, although if I applied it wrongly to myself it would destroy me in an instant, for it is a most intense thing, and the power you see here put forth while you count five [bringing the poles in contact and exhibiting the electric light] is equivalent to the power of several thunder-storms, so great is its force. And that you may see what intense energy it has I will take the ends of the wires which convey the power from the battery behind me, and with it I dare say I can burn this iron file. This is a chemical power, and when we next meet, I shall apply it to water, and show you what results we are able to get.

The Boards of Arts & Manufactures

FOR UPPER AND LOWER CANADA.

The subjoined Memorials have already appeared in the Supplement to the April number of this Journal. They may, however, be again appropriately introduced here, in case it should be thought advisable to omit binding the Supplement with the volume for the year. The notice of the meeting of Architects, Civil Engineers and Provincial Land Surveyors of Canada, is introduced elsewhere, with the same object.

Copy of the Memorial

Submitted by the Board of Arts and Manufactures for Upper Canada, to the Honorable the Legislative Assembly, on the subject of the International Exhibition, to be held in London in 1862.

"Your memorialists respectfully beg leave to address your Honourable House on the subject of

the International Exhibition to be held in London in 1862.

"Your memorialists have the best grounds for the expectation that the proposed Exhibition will exceed in importance and grandeur those illustrations of progressive Industry and Art which elicited the astonishment and admiration of the civilized world, at London in 1851, and at Paris in 1855.

"Your memorialists consider that the honourable position acquired by Canada at those Exhibitions greatly contributed to diffuse information throughout Europe respecting the resources of the Province, to draw the attention of emigrants to it as a field for industry and settlement, as well as to induce numbers of commercial men and capitalists to make it their home or the scene of their enterprise.

"Your memorialists believe that the progress which has been made in our knowledge of the resources of Canada since the year 1855 might greatly enhance the value of any display that could be made in 1862. They believe that the advance in our civilization during the past six years will, if properly represented, exercise a proportionately greater effect upon those who may have the opportunity of comparing 'Canada in 1862' with 'Canada in 1855' or 'Canada in 1851.'

"But while your memorialists are firmly persuaded of the great benefits which might accrue to the country from a proper representation next year at London, of its resources and the civilization of its people, they also believe that without ample pecuniary assistance from Your Honourable House that great object can not be attained.

"With a view to enable our countrymen to exhibit the Progress of their Industry, the increased Extent and Value of the Resources at their command, their Growing Power as an Industrial People, your memorialists humbly pray that Your Honourable House will be pleased to grant that a sum not less than $60,000 of public money may be expended, under proper supervision and control, in assisting to secure a fit representation of the Resources and Civilization of Canada at the International Exhibition of 1862.

"And your memorialists will ever pray, &c."

Copy of the Memorial

Submitted by the Board of Arts and Manufactures for Lower Canada, to the Honorable the Legislative Assembly, on the subject of the International Exhibition, to be held in London in 1862.

"The Memorial of the Board of Arts and Manufactures of Lower Canada, respectfully sheweth:

That Her Most Gracious Majesty hath, by Her Royal Letters Patent, bearing date at Westminster, on the fourth day of February last past, appointed certain Commissioners, creating them a Corporation or body politic and corporate, for the purposes of conducting and managing an International Exhibition of the Products of Industry and Art of all Nations, such Exhibition to be held in or near the Metropolis in the year 1862:

That instructions have been issued (as this Board learns from a published letter of the Royal Commissioners), through His Grace the Secretary of State for the Colonies, to all the British Colonies, to compete at such Exhibition:

That it is exceedingly desirable, should the arrangements made prove to be of a satisfactory nature, that this Province, which won so much distinction in the Great International Exhibitions held in London and Paris in the years 1851 and 1855 respectively, should on this occasion make known to the world, through the coming Exhibition, the steady progress it is making in the opening up of its resources:

That it is therefore advisable that a Commission should be appointed to act in connection with this Board, and the Board of Arts and Manufactures of Upper Canada, and the two Provincial Boards of Agriculture, in obtaining in a similar manner as was done in the year 1854 for the Paris Exhibition, objects to be forwarded to the Great Exhibition to be held in London in the year 1862, and that a sum not exceeding 40,000 dollars should be placed at its disposal for that purpose:

That this Board has reason to believe that the sum named will be amply sufficient to defray all expenses to be incurred, and that after the sale of the articles purchased for Exhibition, ten thousand or fifteen thousand dollars will be returned to the Provincial Treasury:

Wherefore, your Memorialists humbly pray that your Honourable House will be pleased to sanction such grant for the purposes above set forth:

And your Memorialists, as in duty bound, will ever pray, &c."

INTERNATIONAL EXHIBITION OF 1862.

The following is the classification intended to be adopted by Her Majesty's Commissioners for the Great Exhibition of 1862:—

Section I.—Raw Materials.

Mining, Quarrying, Metallurgy, and Mineral products; Chemical Substances and Products, and Pharmaceutical Processes; Substances used for Food, including Wines; Animal and Vegetable Substances used in Manufactures.

Section II.—Machinery and Engineering

Railway Plant, including Locomotive Engines and Carriages; Carriages not connected with rail or tram roads, Manufacturing Machines and Tools; Machinery in general, as applied to industry; Agricultural and Horticultural Machines and implements,

Civil Engineering, Architectural and Building Contrivances; Military Engineering, Armour and Accoutriments, Ordnance and small arms; Naval Architecture and Ships' Tackle; Philosophical Instruments, and Processes depending on their use; Photography, and Photographic Apparatus; Horological Instruments; Musical Instruments; Surgical Instruments and appliances.

[Section III.—Manufactures.

Cotton; Flax and Hemp; Silk and Velvet; Woollen and Worsted, including Mixed Fabrics generally, Carpets; Woven Spun, Felted, and Lace Fabrics, when shown as specimens of Printing or Dyeing; Tapestry, Lace, and Embroidery; Skins, Furs, Feathers, and Hair; Leather, including Saddlery and Harness; Articles of Clothing; Paper, Stationery, Printing, and Bookbinding; Educational Works and Appliances; Furniture and Upholstery, including Paper-hangings and Paper Maché; Iron and General Hardware, Steel, and Cutlery; Works in Precious Metals and their imitations; Jewellery; Glass; Pottery; Manufactures not included in previous Classes.

Section IV.—Fine Arts (Modern).

Architecture; Paintings in Oil and Water Colours and Drawings; Sculpture, Models, Die-sinking, and Intaglios: Etchings and Engravings.

In the Exhibition of 1851 there were only 35 Classes. In the proposed one, therefore, there are five additional.

COMMITTEES.

Her Majesty's Commissioners have appointed the following Committees of Advice:—

FINANCE.

Rt. Hon. R. Lowe, M P.
Sir A. Spearman, National Debt Office.
T. F. Gibson, Esq.
E. A. Bowring, Esq., Board of Trade.
H. Thring, Esq., 16 Duke st., Westminster, S.W.

Lord Frederick Cavendish, *Honorary Secretary.*

BUILDING.

The Earl Shelburne.
William Baker, Esq., C.E.
William Fairbairn, Esq., L.L.D., F.R.S.

FINE ARTS.

The Duke of Buccleuch, K.G.
The Marquis of Lansdowne, K.G.
The Marquis of Hertford, K.G.
The Earl Spencer.
The Earl Stanhope.
The Earl of Malmesbury.
The Earl Somers.
The Earl of Dudley.
The Lord Ashburton.
The Lord Overstone.
The Lord Talbot de Malahide.
The Lord Llanover.
The Lord Taunton.
The Lord Elcho, M.P.
The Lord Chief Baron.
Sir Stafford Northcote, Bart., M.P.
Sir Francis Scott, Bart.
Thomas Ashton, Esq.
R. Henry Cheney, Esq.
Rev. E. Coleridge.
E. C. Field, Esq
R. S. Holford, Esq., M.P.
H. T. Hope, Esq.
John Ruskin, Esq.
Wm. Stirling, Esq., M.P.
S. J. Stern, Esq.
Tom Taylor, Esq.
John Walter, Esq., M.P.
W. Wells, Esq.
The President of the Royal Academy.
The President of the Royal Scottish Academy.
The President of the Royal Hibernian Academy.
The President of the Old Society of Painters and Water Colours.
The President of the Society of British Artists.
The President of the New Society of Painters, in Water Colours.
The President of the Institute of Britsh Artists.
The President of the Royal Institute of British Architects.

P. Le Neve Foster, Esq., *Secretary.*

ORGANIZATION OF COMMITTEES OF CLASSES.

The Marquis of Hartington, M.P.
The Lord Stanley, M.P.
The Lord Naas, M.P.
The Lord Stanley of Alderley.
The Right Hon. the Lord Mayor of London.
The President of the Board of Trade.
The Vice-President of the Board of Trade.
Thomas Bazely, Esq., M.P.
T. F. Gibson, Esq.
Dr. Lyon Playfair, C.B.
H. Cole, Esq., C.B.
W. Dargan, Esq.
The President of the Royal Agricultural Society.
The Chairman of the Society of Arts.
The Chairman of the Royal Dublin Society.
The President of the Institution of Civil Engineers.
The President of the Institution of Mechanical Engineers.
Presidents of Chambers of Commerce.
Edgar A. Bowring, Esq., *Honorary Secretary.*

Every article produced or obtained by human industry, whether of

Raw materials,
Machinery
Manufactures, or
Fine Arts,

will be admitted to the Exhibition, with the exception of

1. Living animals and plants.
2. Fresh vegetable and animal substances, liable to spoil by keeping.
3. Detonating or dangerous substances.

Spirits, or alcohols, oils, acids, corrosive salts, and substances of a highly inflamable nature, will not be admitted, unless sent in well secured glass vessels.

The articles exhibited will be divided into the following classes:—

SECTION 1.

CLASS 1. Mining, Quarrying, Metallurgy, and Mineral Products.
" 2. Chemical Substances and Products, and Pharmaceutical Processes.
" 3. Substances used for Food, including Wines.
" 4. Animal and Vegetable Substances used in Manufactures.

SECTION 2.

CLASS 5. Railway plant, including Locomotive Engines and Carriages.
" 6. Carriages not connected with Rail or Tram Roads.
" 7. Manufacturing Machines and Tools.
" 8. Machinery in general.
" 9. Agricultural and Horticultural Machines and Implements.

CLASS 10. Civil Engineering, Architectural, and Building Contrivances.
" 11. Military Engineering, Armour and Accoutrements, Ordnance, and Small Arms.
" 12. Naval Architecture, Ship's tackle.
" 13. Philosophical Instruments and Processes depending upon their use.
" 14. Photographic Apparatus and Photography.
" 15. Horological Instruments.
" 16. Musical Instruments.
" 17. Surgical Instruments and Appliances.

SECTION 3.

CLASS 18. Cotton.
" 19. Flax and Hemp.
" 20. Silk and Velvet.
" 21. Woollen and Worsted, including Mixed Fabrics generally.
" 22. Carpets.
" 23. Woven, Spun, Felted, and Laid Fabrics, when shown as specimens of Printing or Dyeing.
" 24. Tapestry, Lace, and Embroidery.
" 25. Skins, Fur, Feathers, and Hair.
" 26. Leather, including Saddlery and Harness.
" 27. Articles of Clothing.
" 28. Paper, Stationery, Printing, and Bookbinding.
" 29. Educational Works and Appliances.
" 30. Furniture and Upholstery, including Paper-hangings and Papier-machié.
" 31. Iron, and General Hardware.
" 32. Steel and Cutlery.
" 33. Works in Precious Metals, and their imitations, and Jewellery.
" 34. Glass.
" 35. Pottery.
" 36. Manufactures not included in previous classes.

SECTION 4.

CLASS 37. Architecture.
" 38. Paintings in Oil and Water Colours, and Drawings,
" 39. Sculpture, Models, Die-sinking, and Intaglios.
" 40. Etchings and Engravings.

Her Majesty's Commissioners will be prepared to receive all articles which may be sent to them, on or after Wednesday, the 12th of February, and will continue to receive goods until Monday, the 31st of March, 1862, inclusive.

Articles of great size or weight, the placing of which will require considerable labour, must be sent before Saturday, the 1st of March, 1862; and manufacturers wishing to exhibit machinery, or other objects, that will require foundations or special constructions, must make a declaration to that effect on their demands for space.

Any exhibitor whose goods can properly be placed together, will be at liberty to arrange such goods in his own way, provided his arrangement is compatible with the general scheme of the Exhibition, and the convenience of other exhibitors.

Where it is desired to exhibit processes of manufacture, a sufficient number of articles, however dissimilar, will be admitted for the purpose of illustrating the process; but they must not exceed the number actually required.

Exhibitors will be required to deliver their goods at the building, and to unpack and arrange them, at their own charge and risk; and all articles must be delivered with the freight, carriage, porterage, and all charges and dues upon them paid.

Packing cases must be removed at the cost of the exhibitor or his agent, as soon as the goods are examined and deposited in charge of the Commissioners.

Exhibitors will be permitted, subject only to the necessary general regulations, to erect, according to their own taste, all the counters, stands, glass frames, brackets, awnings, hangings, or similar contrivances which they may consider best calculated for the display of their goods.

Exhibitors must be at the charge of insuring their own goods, should they desire this security. Every precaution will be taken to prevent fire, theft, or other losses, and Her Majesty's Commissioners will give all the aid in their power for the legal prosecution of any person guilty of robbery or wilful injury in the Exhibition, but they will not be responsible for losses or damage of any kind which may be occasioned by fire or theft, or in any other manner.

Exhibitors may employ assistants to keep in order the articles they exhibit, or to explain them to visitors, after obtaining written permission from Her Majesty's Commissioners; but such assistants will be forbidden to invite visitors to purchase the goods of their employers.

Her Majesty's Commissioners will provide shafting, steam (not exceeding 30 lbs. per inch), and water, at high pressure, for machines in motion.

Intending exhibitors in the United Kingdom, are requested to apply to the Secretary to Her Majesty's Commissioners, at the offices 454, West Strand, London, W.C., for a *Form of Demand for Space*, stating at the same time in which of the four Sections they wish to exhibit.

Foreign and Colonial exhibitors should apply to the Commission, or other Central Authority appointed by the Foreign or Colonial Government, as soon as notice has been given of its appointment.

Her Majesty's Commissioners having consulted a Committee as to the organization of the Fine Art Department of the Exhibition, will publish the rules relating thereto at a future date.

By Order,

F. R. SANDFORD,
Secretary.

Office, of Her Majesty's Commissioners,
454 West Strand, London, W.C.

Decisions of Her Majesty's Commissioners on Points relating to the Exhibition.

March, 1861.

Her Majesty's Commissioners have fixed upon Thursday, the 1st day of May, 1862, for opening the Exhibition.

The Exhibition building will be erected on a site adjoining the gardens of the Royal Horticultural Society, and in the immediate neighbourhood of the ground occupied in 1851, on the occasion of the first International Exhibition.

The portion of building to be devoted to the exhibition of Pictures, will be erected in brick, and will occupy the entire front towards Cromwell-road; the portion in which Machinery will be exhibited will extend along Prince-Albert's-road, on the west side of the gardens.

All works of Industry to be exhibited should have been produced since 1850.

Subject to the necessary limitation of space, all persons whether designers, inventors, manufacturers, or producers of articles will be allowed to exhibit; but they must state the character in which they do so.

Her Majesty's Commissioners will communicate with Foreign and Colonial exhibitors only through the Commission which the Government of each Foreign Country or Colony may appoint for that purpose; and no article will be admitted from any Foreign Country or Colony without the sanction of such Commission.

No rent will be charged to exhibitors.

Prizes, or rewards for merit, in the form of medals, will be given in the Industrial Department of the Exhibition.

Prizes may be affixed to the articles exhibited.

THE PROPOSED NEW DYE FROM A COCCUS.

Having had our attention directed to the following paragraph, which has appeared in several newspapers, we desire to notice an objection to the proposed cultivation of this species of coccus. While it is our earnest wish to foster and advance, as much as in us lies, the production of anything—especially Canadian,—that is likely to be of service in the Arts and Manufactures, we cannot but consider the preservation of our forests, which would in all probability be greatly injured by such an insect as this, if encouraged to propagate freely, to be a subject of paramount importance.

"At a meeting of the Botanical Society of Kingston, Professor Lawson exhibited specimens of a new dye of great richness, prepared in the laboratory of Queen's College, from an insect, a species of Coccus, found for the first time last summer on a tree of the common black spruce (Abies nigra, Poir), in the neighbourhood of Kingston. This new dye closely resembles true cochineal, a most expensive coloring matter capable of being produced in warm countries only, and which is used to give a fine and permanent dye in red, crimson, and scarlets, to wool and silk. Unlike cochineal, the new dye discovered at Kingston, is a native Canadian product, and capable of being produced in temperate countries. Having been but recently observed, sufficient quantity has not yet been obtained for a complete series of experiments as to its nature and and uses; but the habits of the insect, as well as the properties of the dye, seem to indicate that it may become of practical importance. In color it closely resembles ordinary cochineal, having rather more the scarlet hue of the flowers of adonis autumnalis, and no doubt other shades will be obtained. The true cochineal is now being cultivated in Teneriffe and other vine-growing countries of Europe and Africa, with such success as to displace the grape vine; yet the Directors of the East India Company offered in vain £2,000 for its introduction into India."

We are ourselves unacquainted with the insect mentioned above, but have frequently observed others of kindred species. On the white spruce (*abies alba*, Michaux), for instance, may often be seen a species of coccus (*C. pinicortis*, Fitch,) in the form of a white cotton, or down-like substance, covering a vast number of minute insects of a black, or blackish-brown color, closely huddled together, and clinging to the bark. Dr. Fitch, in his report on the noxious, &c., insects of New York, remarks with respect to this insect, that "when a tree is much coated with this white substance, it becomes sickly, and presents a slender, dwindled appearance, its leaves are short and stinted in their growth, and of a dull green color, and the annual growth of the tree is much curtailed." The coccidæ belong to the order Homoptera, all the insects of which subsist upon vegetable jucies, which they obtain by means of a sort of proboscis. According to Westwood, in his Modern Classification of Insects, the coccidæ, "which are ordinarily of very small size, are amongst the most injurious insects to the interests of the horticulturist and arboriculturist: their powers of propagation are excessive: when they once gain possession of a plant or young tree, its death is almost certain, the minute size of the larva rendering it impossible to exterminate them. Sometimes they are so numerous, that I have seen instances in which the entire surface of a branch of an apple tree has been completely covered with them. They are well known to gardeners and others under the name of scale insects and mealy bugs; the former especially, affixing themselves to the twigs; and the females by degrees, assuming the appearance of galls." We learn from the same authority that the typical species of this family is the *coccus ilicis*, Linn, found in the south of Europe, and from which the Greeks derived their famous dye *kokkos*, the *coccus baphica* of the Romans, and *kermes* of the Arabs. The cochineal insect however, he distinguishes from the preceding, and calls by the generic name of *pseudo-coccus*. Kirby and Spence in their introduction to Entomology—when giving an

account of the various indirect injuries inflicted upon man by insects, mention various species of coccus as committing great ravages upon the currant, the plum, apple, peach, olive, vine, &c. That on the apple-tree, they state, was thought to have been introduced from America, whence its common name of *American blight;* it was at first confined to the neighbourhood of London, where it destroyed thousands of trees; afterwards it found its way to the cider counties, where it committed an infinity of damage. But what need is there of adducing further authorities and examples respecting the pernicious effects produced by insects of this genus; enough have surely been cited to shew that we base our objections to the cultivation of this insect on something more than ideas derived from personal observations, and that our opinion is upheld by those who have investigated the matter most thoroughly. In fine, we have not a doubt but that, were the production of this insect to be encouraged, since it naturally increases with such excessive rapidity, it would soon prove a dreadful pest to our forests, which are daily increasing in value, though the preservation of them is, we regret to say, even yet but too little regarded by the majority among us.

THE BOTANICAL SOCIETY OF CANADA.

Annals of the Botanical Society of Canada. Vol. 1, part 1, 4to, pp. 60. Kingston: Creighton.

Here we have the first fruits of the labours of a society, the existence of which, supplies a necessity of our provincial life, and which has before it a bright prospect of distinction and usefulness.

Professor Lawson, of Queen's College Kingston, the Secretary to the society, brings to it the experience he has gained from the discharge of similar duties in Edinburgh. He is a scientific botanist of established reputation, and a gentleman in whose hands the general interests of this association are secure. The president, Principal Leitch, fills the chair at the meetings of the society, and insures the success of these re-unions by his judgment, taste and skill, as their director.

The evenings appointed for the monthly meetings of the society have too commonly turned out severely cold, or wet, or stormy; and the unlighted streets of Kingston are not to be trodden on a winter night, without some danger of a fall; but the difficulty of going and returning has not deterred the citizens from seeking pleasure and instruction on every offered opportunity.

The place for assembling in, is the convocation-hall of the University, a plain apartment, in shape a parallelogram, and of moderate size. Though it is, in appearance, a room easily to be filled by any voice of ordinary power, it must be stated with regret, that the readers of the many valuable papers contributed, have too often failed to make themselves distinctly audible to the whole assembly.

The audience have shown themselves intelligent, interested, appreciative,—that considerable portion of them, the students of the college, have been hearty in their applause, and quick to recognise talent in the treatises read, especially when they have been the productions of any members of their own university.

On the conclusion of the business of the sittings, it has been customary to withdraw to another apartment, where tea and refreshments have been hospitably provided, and botanical specimens exhibited.

The botanical society of Canada has gained the warm support of many eminent botanists abroad. In an important letter received by the Secretary, from Sir W. J. Hooker, he calls upon Canadian botanists to review the whole flora of their respective neighbourhoods, and to forward to him dried specimens when needed, in order to his assigning their *Canadian habitats* to all plants found within the province, in future editions of his works on American botany. It may, however, be conjectured, that Sir Wm. Hooker wrote in ignorance of the intention of Professor Hincks to publish a flora of Canada; a purpose lately made known, much to the delight of our provincial botanists.

The business of the Canadian botanical society hitherto, has taken a very practical course, a fact which commends the institution to the favor of a journal like this. Usefulness being a main consideration, no "Chinese exactness" has been shown in confining their speculations to the vegetable world. Thus,—papers have been read on Maple trees and sugar making. Good news has been provided for the epicure and the housekeeper in reference to those many species of edible fungi, which are growing ready to their hands, waiting only to be gathered, cooked, and eaten. A cochineal insect, found on the black spruce near Kingston, has been described, and the probability of its furnishing a valuable dye has been considered. Vegetable fibres have received much attention. A paper on cotton has been presented,—important information has been given on the properties of fibres obtained from some of our indigenous plants, such, for example, as Asclepias incarnata. In connection with the subject of serviceable fibres, silk of course was not to be ignored; and the society has been favoured with some interesting papers, the productions of two lady silk worm breeders. One of the fair essayists adheres firmly to the opinion adopted by those engaged in the silk trade, that the caterpillar of Bombyx Mori, when fed only on lettuce leaves, cannot produce a thread fit for the loom. Her gentle antagonist is strong in the belief that the lettuce fed silk worm can and does spin a thread of highly serviceable kind. She produces specimens of such silk, as wound off from the cocoon, and calls on all sceptics to test its strength.

Two most important papers on the subject of bees have been communicated to the society by their president. In his remarks upon the subject, which were in part unwritten, Dr. Leitch was understood as inclining to the belief that *the male* egg of the bee, being placed in the cell prepared for the nidus of the queen-egg, being

hatched therein, and treated by the working bees its nurses, as a royal larva, might come forth at last a queen *i. e., a fertile female!* The peculiar treatment of the immature occupant of a royal cell, seems to him to consist rather in the maintenance of a high * temperature around it, than in supplying it with any special kind of food.

Now this supposed change of sex must certainly be pronounced improbable in an extreme degree, and the testimony of experience can also be produced against it. An article upon the honey-bee appeared in the *London Quarterly Review* about ten years ago, which was republished in a little volume—" READING FOR THE RAIL." It is there affirmed, as from an eye witness, that a male egg *is* sometimes laid by accident in a cell intended for a queen, that the bees feed and tend the changeling through all the early stages of its life, as if it were a queen *in posse*,—that it comes forth at last a drone, "a nasty male critter,"—and that its nurses discover their mistake then, and not till then.

There will be no more evening meetings of the Botanical Society until next winter, but out-door excursions during the summer months are promised and expected. The writer of this notice need only express his hope that these anticipated field-days will be pleasant and instructive, like some which he recalls to mind as having been organised and conducted by Professor Henslow of Cambridge, some quarter of a century ago, and that, when they do come off, " he may be there to see."

* Not long ago a French Provincial newspaper stated as a fact, that a little girl had been struck by lightning and rendered insensible. She recovered yet did not *come* exactly to *herself*, for her sex was found to have been changed.

THE ONTARIO WOOLLEN MILLS.

The following excellent notice of the Ontario Woollen Mills, is from the Toronto *Leader*. In one unimportant feature the description requires a slight modification, which has been supplied to us from the proprietors of the mills; it relates to the process of fulling in different seasons of the year, and the effect it has upon the amount of work done.

During the summer the hands are engaged in carding the coarser kinds of wool for the winter fabrics, and thus the operations does not go on so speedily as when the fine varieties of wool are subjected to the same process for the production of light summer cloths, and this is owing to the smaller weight of wool being required for the finer materials. It is this difference in material rather than the heat of the weather, which occasions a diminution in the quantity of work obtained.

The largest woollen manufactory in the country is situated at Cobourg, on a stream which generally suffices to supply all the motive power required; and just above the Ontario Woollen Mills—for such is the name of the factory in question—the Hon. Sidney Smith owns another valuable hydraulic power, which has not yet been economized. In these mills, to make doubly sure, there is auxiliary steam power, which serves to prevent any freezing about the water wheels, to heat the building in winter, and to assist in the propulsion of the machinery when the heavier fabrics are being made, for winter use, in the summer season. With green wood at $2.50, and dry at $3, it is used instead of coal, for heating, dyeing, drying, and whatever other purposes it is required for. A very small rise in the price would render the use of coal an economy to which it would be necessary to resort. The factory building, composed of brick, is 100 by 50, and five stories high, with large wings. The value of the machinery is about $60,000. The products are woollen tweeds, cloths and satinets. About 100 hands are employed, by Messrs. Frazer & Co., by whom the mills are carried on; thirty-five of whom are females, and fifteen boys; the remainder being men. The average produce is from 650 to 850 yards a day; the smaller amount being produced in summer, when the heavier kinds of goods are being manufactured for winter use. Owing to the heat of the weather, the fulling cannot be conducted so rapidly, at that season of the year; and the other processes have to wait upon this. Doubtless also, though it may be imperceptible, the summer heat tends, by relaxing the system of the operatives, to diminish the production. This is found to be the case in the cotton mills of New England. The same number of hands are at work: and there is no interruption in any department: everything seems to go on precisely as in winter; but the production is less. Doubtless, however, the main cause of the diminished production of woollen frabrics during the summer arises from the check given to the fulling process. The product of these mills is all readily bought up; and it is sold entirely to wholesale houses. The annual consumption of wool is about 200,000 lbs, chiefly of Canadian growth.

In the different stories of the Ontario Woollen Mills may be seen in full activity all the processes of sorting wool, cleansing, dyeing and carding it; spinning, weaving—and this presents the most animated scene, one entire floor being crowded with machinery in active operation—fulling, gigging, scouring, dyeing, finishing and hot-pressing. You might look into a Manchester factory and not be more instructed or impressed with the scene. We think we are justified in pointing to these mills for satisfactory proof that woollen manufactures may be made to pay in Canada. The mills when in other hands, were stopped once, but it by no means follows that there ought, with adequate capital, care and economy, to have been a failure even then. Our tariff was at that time somewhat lower; but we cannot accept even that temporary stoppage as proof that the manufacture of woollen goods in Canada, was an impossible operation. Of their kind, the fabrics produced at these mills are excellent, and quite able successfully to compete with any imported, whether from England, Scotland or the United States.

ASSOCIATION OF ARCHITECTS, CIVIL ENGINEERS AND PROVINCIAL LAND SURVEYORS OF CANADA.

At a meeting of this Association held in Toronto on the 6th of February last, George Brown, Esq., of Montreal, 1st Vice-President, in the chair, the question of an uniform system of measurement of Artificers work was brought up on a report from the Special Committee. The subject was very fully discussed, there being a very large number of members present, who took great interest in the matter. The report recommended the application of a decimal system similar to that in general use on the Continent

of Europe, but the majority considered that such a mode, however convenient, would be next to impracticable in this Province. It was therefore resolved to refer back the report, with instructions to adapt, as far as possible, the system set forth in Laxton's *Price Book*, which contains the rules regulating the general measurement of work in England. A Paper was received from Mr. Hanvey of St. Thomas, "On the Allowance to be made for the Curvature of the Earth in surveying," which was appointed to be read at the next meeting. A resolution was passed sympathising with the family of the late lamented President of the Association, Wm. Thomas, Esq. The 1st Vice-President, Mr. Brown, having vacated the chair, a vote of thanks was accorded him for his zeal in making a journey from Montreal at so inclement a season of the year to attend the meeting, and for his able conduct in the chair. The meeting then adjourned.

The Association met again at Toronto for the nomination of officers, on the 6th March last, Wm. Hay, Esq., Architect, Toronto, in the chair. After the nomination, which was the chief business of the meeting, an interesting discussion ensued on Mr. Hanvey's paper, presented at the previous meeting, in which Mr, J. O. Browne, of Toronto, Mr. Peters, of London, and others took part. The question greatly affects the practice of surveying in this Province, where frequently the first line of a survey is run on a true meridian, and the others parallel or rectangular to it. It was generally admitted that the polar lines should be true local meridians, and that some alteration in the Statute directing the mode of surveying for the Province is required. Mr. Peters having been called to the chair, a vote of thanks was given to Mr. Hay for the able manner in which he presided at the meeting.

Correspondence.

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—When the Prospectus of your Journal was issued in November last, I was much pleased to notice that you intended to publish abstracts of reports and proceedings of the several Mechanics' Institutes in Upper Canada, whenever furnished for that purpose; and that you also invited correspondence in relation thereto.

I have been anxiously looking for correspondence on this subject, as each issue of the Journal has appeared, but have so far had to look in vain.

I believe the general impression is that the Mechanics' Institutes in this Province are, with few exceptions, in anything but a prosperous condition; and that unless new life and energy are thrown into their management, a large number of them will soon cease to exist, or will exist only in name without fulfilling any of the important duties which properly devolves upon them.

Taking up the *St. Catharine's Semi-Weekly Post* of the 9th instant, I noticed some lengthy editorial remarks respecting the Mechanics' Institute in that town, from which it appears that, in 1859, its library contained nearly 1400 volumes of books, since which time no books have been added. That while the town has increased within a certain period from 4,500 to 6,500 of a population, the Institute has decreased at a greater ratio, and that the Institute has been so much involved in consequence, that during the past Winter no fire could be allowed the Librarian on the two evenings in each week that the library has been kept open.

The *Post* takes the professional men, the merchants, and the mechanics, sorely to task for allowing such a state of things to exist, and I have no doubt but they richly deserve it, for their culpable neglect of so valuable an institution as it would become if generously supported; but still I cannot help thinking, Mr. Editor, but that the management of that institution has been very remiss in the discharge of duty, or it would not be in such a deplorable condition as is pictured by the Journal referred to—a picture, I fear, that might be truthfully drawn of many other such institutions in the province.

Let the managers of the St. Catharines Mechanics' Institute, or of any others so favourably situated as to population, secure a comfortable room for a library, and also a reading room comfortably seated, well lighted and kept open every evening, and having, in addition to necessary papers containing the current news of the day, a moderate supply of such works as the London Illustrated News, and Times, Punch, and Harper's Weekly, and a few of the best Magazines of Literature and Science, and I confidently predict that such rooms will be well attended, and become an object of interest in their respective localities.

I remember when the Toronto Mechanics' Institute had less than one hundred members, and only two of those taking books from the Library, yet, from adopting the course I have indicated, its membership numbered in the year 1858 upwards of 800, of whom 650 were regularly taking out books.

Such a result is well worth the effort made, especially when we consider that in all cities and towns of any magnitude there is a large class of young men, merchants and mechanics, who have no home but a boarding house, or a residence with their employers, which in many cases is to them even more cheerless than ordinary boarding houses, comfortless as they are in too many instances. To this class, a judiciously selected library of books and a comfortable reading room, in which to spend their evenings when not otherwise engaged, is a positive boon, and I have no doubt is so esteemed by a large proportion of this class of individuals.

In addition to a library and reading room, a lecture room should be secured if possible, where, through the Winter season, weekly lectures might be delivered; and in anything approaching a populous community, I cannot imagine any great difficulty in obtaining gratuitous lectures from the various ministers and professional gentlemen of the neighbourhood.

I am aware that considerable prejudices have of late arisen in regard to such lectures, as being too unconnected in the subjects treated of to be of any practical value to those who attend them. In that opinion I do not at all agree; for although no large amount of information can be obtained by listening to one single lecture on any given subject, yet the attention may be awakened and an interest excited, that may lead to a course of consecutive reading on the subject treated upon by the lecturer.

Indeed I am of opinion that, unless of a very popular character, one lecture, or at the most two, on any one subject during the same session, will be the most beneficial to the Institute and to the Public.

I had intended to refer to the establishment of classes in the several institutions, both as a means of instruction and amusement, but will leave that subject for the present, hoping some abler hand will take it up in the next number of the Journal. I trust also that others will follow the example of Dundas and Hamilton, in furnishing abstracts of reports and proceedings of their annual meetings, thus supplying each association with information as to what other institutions are doing, and awakening a spirit of emulation amongst them which will undoubtedly tend to their general benefit.

Yours, &c. &c.

A Member T. M. I.

Toronto, April 26th, 1861.

NOTICES OF BOOKS.

An Introduction to Entomology, or Elements of the Natural History of Insects: comprising an account of Noxious and Useful Insects, of their Metamorphoses, Food, Stratagems, Habitations, Societies, Motions, Noises, Hybernation, Instinct, &c. By Rev. William Kirby, M.A., F.R.S., F.L.S.; and William Spence, Esq., F.R.S., F L.S. Seventh edition, with an appendix relative to the Origin and and Progress of the work—1 vol., crown 8vo. pp. 607. London: Longman & Co. Price $1 50.

To pass any comments upon a book that has been stamped with the approbation as well of the learned as of ordinary readers, for upwards of forty years, and which now appears in its *seventh* edition, would be presumption on our part. We merely desire, while paying our tribute of admiration and approval, to bring it under the notice of those of our readers who are not yet acquainted with it, and to inform them where they can gain access to this very mine of instruction and amusement. There is probably no other work in the English language that has done more than this to spread the taste for Natural History, and to direct it to the vast field for observation afforded by the transformations, habits, and instincts of the countless species of insects. Its popularity has not been confined to one country, or even to one tongue, but by means of translations, and through the effect it has undoubtedly exercised over many of the best elementary books in other languages, its influence has been extended far and wide. The present edition is published in one volume, and at less than one-sixth of the price of the former one, thus placing it within the reach of all; its value is further enhanced by an addition from the pen of Mr. Spence (who survived his associate by about ten years), detailing, in the shape of letters and recollections the origin and progress of the work, and giving an account of the life-long friendship of the learned authors, who, after having originated and carried out the undertaking, so long survived its completion, and shared in its success.

The title affords a very good index to the contents of the work; the book opens with an introductory letter, giving a general view of the science of Entomology, and showing that it possesses attractions sufficient to reward any one who diligently studies it. The authors next go on to answer (which they do most conclusively) all the objections that are usually urged against this pursuit. Any one who imagines that it leads to inhumanity and cruelty, and is on that account to be avoided, has but to read onr author's masterly refutation of this charge to perceive its unreasonableness and inconsistency, and to feel that the converse of what our great poet says,

> "The poor beetle that we tread upon,
> In corporeal sufferance feels a pang as great
> As when a giant dies,"

is nearer the truth. The next chapter gives an account of the metamorphoses of insects, a matter interesting alike to the moralist and the naturalist. The authors then take up the subject of the injuries and benefits derived from insects, shewing how important these minute creatures are as instruments both of evil and good; how closely connected with them are our prosperity, comfort, and happiness, and consequently how extremely useful and necessary is the knowledge and study of them. They then pass on to the more interesting parts of their history, those namely, that relate to their affection for their young, their food and methods of obtaining it, their habitations, societies, &c. From the observation of all which "it is clear—to quote the words of the authors themselves—that by these creatures and their instincts, the power, wisdom, and goodness of the Great Father of the universe are loudly proclaimed; the atheist and infidel confuted; the believer confirmed in his faith and trust in Providence, which he thus beholds watching with incessant care, over the welfare of the meanest of his creatures; and from which he may conclude that he, the prince of the creation, will never be overlooked or forsaken; and from them what lessons may be learned of patriotism, and self-devotion to the public good; of loyalty, of prudence, temperance, diligence, and self-denial." The remainder of the work treats of the means of defence possessed by insects, their motions, noises,

hybernations, and finally their instincts, all subjects alike interesting and instructive. In conclusion we have but to say to all, both old and young, parents and children, 'buy and read,' enjoy yourselves all the strange accounts of insect history and economy, which have been collected with so much study and diligence, combined with personal observation, and put forth with so much taste and judgment by these talented authors. We venture to affirm that time thus bestowed will never be regarded as lost, òr spent in vain.

Selected Articles.

ON SOME POINTS IN AMERICAN GEOLOGY.*

BY T. STERRY HUNT, M.A., F.R.S., OF THE GEOLOGICAL SURVEY OF CANADA.

The recent publication of two important volumes on American geology seems to afford a fitting occasion for reviewing some questions connected with the progress of geological science, and with the history of the older rock formations of North America. The first of these works is the third volume of the Palæontology of New York by James Hall; we shall not attempt the task of noticing the continuation of this author's labors in the study of organic remains, labors which have by common consent placed him at the head of American palæontologists, but we have to call attention to the introduction to this 3rd volume, where in about a hundred pages Mr. Hall gives a clear and admirable summary of the principal facts in the geology of the United States and Canada, followed by some theoretical notions on the formation of mountain chains, metamorphism and volcanic phenomena, where these questions are discussed from a point of view which we conceive to be of the greatest importance for the future of geological science. A publication of this introduction in a separate form, with some additions, would we think be most acceptable to the scientific public.

The other work before us is Prof. H. D. Rogers' elaborate report on the geology of Pennyslvania, giving the results of the Survey of that State for many years carried on under his direction, and embracing a minute description of those grand exhibitions of structural geology, which have rendered that State classic ground for the student. The volumes are copiously illustrated with maps, sections and figures of organic remains, and the admirable studies on the coal fields of Pennsylvania and Great Britain add much to its value.

The oldest series of rocks known in America is that which has been investigated by the officers of the Geological Survey of Canada, and by them designated the Laurentian system. It is now several years since we suggested that these rocks are the equivalents of the oldest crystalline strata of western Scotland and Scandinavia.† This identity has since been established by Sir R. I. Murchison in his late remarkable researches in the north-western Highlands, and he has adopted the name of the Laurentian system for these ancient rocks of Ross, Sutherland, and the Western Islands, which he at first called fundamental gneiss.* These are undoubtedly the oldest known strata of the earth's crust, and therefore offer peculiar interest to the geologist. As displayed in the Laurentide and Adirondack mountains they exhibit a volume which has been estimated by Sir William Logan to be equal to the whole palæozoic series of North America in its greatest development. The Laurentian series consists of gneiss, generally granitoid, with great beds of quartzite, sometimes conglomerate, and three or more limestone formations, (one 1000 feet in thickness) associated with dolomites, serpentines, plumbago, and iron ores. In the upper portion of the series an extensive formation of rocks, consisting chiefly of basic feldspars without quartz and with more or less pyroxene, is met with. The peculiar characters of these latter strata, not less than the absence of argillites and talcose and chloritic schists, conjoined with various other mineralogical characteristics, seem to distinguish the Laurentian series throughout its whole extent, as far as yet studied, from any other system of crystalline strata. It appears not improbable that future researches will enable us to divide this series of rocks into two or more distinct systems.

Overlying the Laurentian series on Lakes Huron and Superior, we have the Huronian system, about 10,000 feet in thickness, and consisting to a great extent of quartzites, often conglomerate, with limestones, peculiar slaty rocks, and great beds of diorite, which we are disposed to regard as altered sediments. These constitute the lower copper-bearing rocks of the lake region, and the immense beds of iron ore at Marquette and other places on the south shore of Lake Superior have lately been found by Mr. Murray to belong to this series, which is entirely wanting along the farther eastern outcrop of the Laurentian system. This Huronian series appears to be the equivalent of the Cambrian sandstones and conglomerates described by Murchison, which form mountain masses along the western coast of Scotland, where they repose in detached portions upon the Laurentian series.

Besides these systems of crystalline rocks, the latter of which is local and restricted in its distribution, we have along the great Apalachian chain, from Georgia to the Gulf of St. Lawrence, a third series of crystalline strata, which form the gneissoid and mica slate series of most American geologists, the hypozoic group of Prof. Rogers, consisting of feldspathic gneiss, with quartzites, argillites, micaceous, epidotic, chloritic, talcose and specular schists, accompanied with steatite, diorites and chromiferous ophiolites. This group of strata has been recognized by Safford in Tennessee, by Rogers in Pennyslvania, and by most of the New England geologists as forming the base of Appalachian system, while Sir William Logan, Mr. Hall, and the present writer have for many years maintained that they are really altered palæozoic sediments, and superior to the lowest fossiliferous strata of the Silurian series. Sir William Logan has shown that the gneissoid ranges in Eastern Canada have the form of synclinals, and are underlaid by shales which exhibit fossils in their prolongation, while his sections leave no doubt that these ranges of gneiss, with micaceous, chloritic, talcose and specular schists, epidosites, quartzites, diorites and ophiolites, are really the altered sediments of the Quebec group, which is a lower member of the Silurian series, corresponding to the Calci-

*(From the *American Journal of Science* for May, 1861.)

† Esquisse Geologique du Canada, 1855, p. 17.

* Quar. Journal Geol. Society, vol. xv. 353: xv.; 215.

ferous and Chazy formations of New York, or to the Primal and Auroral series of Pennsylvania. Prof. Rogers indeed admits that these are in some parts of Pennsylvania metamorphosed into feldspathic, micaceous and talcose rocks, which it is extremly difficult to distinguish from the hypozoic gneiss, which latter, however, he conceives to present a want of conformity with the palæozoic strata.

To this notion of the existence of two groups of crystalline rocks similar in lithological character but different in age, we have to object that the hypozoic gneiss is identical with the Green Mountain gneiss, not only in lithological character, but in the presence of certain rare metals, such as chrome, titanium, and nickel which characterise its magnesian rocks; all of these we have shown to be present in the unaltered sediments of the Quebec group, with which Sir William Logan has identified the gneiss formation in question. Besides which the lithological and chemical characters of the Appalachian gneiss are so totally distinct from the crystalline strata of the Laurentian system, with which Professor Rogers seem to identify them, that no one who has studied the two can for a moment confound them. Prof. Rogers is therefore obliged to assume a new series of crystalline rocks, distinct from both the Laurentian and Huronian systems, but indistinguishable from the altered palæozoic series, or else to admit that the whole of his gneissic series in Pennyslvania is, like the corresponding rocks in Canada, of palæozoic age.* We believe that nature never repeats herself without a difference, and that certain variations in the chemical and mineralogical constitution of sediments mark successive epochs so clearly that it would be impossibie to suppose the formation in adjacent regions of a series of crystalline schists like those of the Alleghanies contemporaneous with the sediments which produced the Laurentian system. We have elsewhere indicated the general principles upon which is based this notion of a progressive change in the composition of sediments, and shown how the gradual removal of alkalies from aluminous rocks has led to the formation of argillites, chloritic and epidotic rocks, at the same time removing carbonic acid from the atmosphere, while the resulting carbonate of soda by decomposing the calcareous and magnesian salts of the ocean, furnished the carbonates for the formation of limestones and dolomites, at the same time generating sea salt.†

Closely connected with these chemical questions is that of the commencement of life on the earth. The recognition beneath the Silurian and Huronian rocks of 40,000 feet of sediments analogous to those of more recent times, carries far back into the past the evidence of the existence of physical and chemical conditions, similar to those of more recent periods. But these highly altered strata exclude, for the most part, organic forms, and it is only by applying to their study the same chemical principles which we now find in operation that we are led to suppose the existence of organic life during the Laurentian period. The great processes of deoxydation in nature are dependent upon organization; plants by solar force convert water and carbonic acid into hydrocarbonaceous substances, from whence bitumens, coal, anthracite and plumbago, and it is the action of organic matter which reduces sulphates, giving rise to metallic sulphurets and sulphur. In like manner it is by the action of dissolved organic matters that oxyd of iron is partially reduced and dissolved from great masses of sediments, to be subsequently accumulated in beds of iron ore. We see in the Laurentian series beds and veins of metallic sulphurets, precisely as in more recent formations, and the extensive beds of iron ore hundreds of feet thick, which abound in that ancient system, correspond not only to great volumes of strata deprived of that metal, but as we may suppose, to organic matters, which but for the then greater diffusion of iron oxyd in conditions favorable for their oxydation, might have formed deposits of mineral carbon far more extensive than those beds of plumbago which we actually meet with in the Laurentian strata.

All these conditions lead us then to conclude to the existence of an abundant vegetation during the Laurentian period, nor are there wanting evidences of animal life in these oldest strata. Sir William Logan has described forms occuring in the Laurentian limestone which cannot be distinguised from the silicified specimens of *Stromatopora rugosa* found in Lower Silurian rocks. They consist of concentric layers made up of crystalline grains of white pyroxene in one case and of serpentine in another, the first imbedded in limestone and the second in dolomite; we may well suppose that the result of metamorphism would be to convert silicified fossils into silicates of lime and magnesia. The nodules of phosphate of lime in some beds of the Laurentian limestones also recall the phosphatic coprolites which are frequently met with in Lower Silurian strata, and are in the latter case the exuviæ of animals which have fed upon *Lingula, Orbicula, Conularia* and *Serpulites*, the shells and tubes of which we have long since shown to be similar in composition to the bones of vertebrates.* So far therefore from looking upon the base of the Silurian as marking the dawn of life upon our planet, we see abundant reasons for supposing that organisms, probably as varied and abundant as those of the palæozoic age, may have existed during the long Laurentian period.

Along the northren rim of the great palæozic basin of North America the potsdam sandstone of the New York geologists is unquestionably the lowest rock from below Quebec to the Island of Montreal, and thence passing up the valley of Lake Champlain and sweeping round the Adirondack mountains, until it reënters Canada and soon disappears to the north of Lake Ontario, where the Birdseye and Black River limestones repose directly upon the Laurentian rocks, and furthermore overlie the great Lake Superior group of slates and sandstones, which reposing on the unconformable Huronian system, constitutes the upper copper-bearing rocks of this region. This Lake Superior group, as Sir William Logan remarks,

* Dr. Bigsby in 1824 described an extensive tract of gnessoid rocks on Rainy Lake and Lake Lacroix, north of Lake Superior. The general course of the strata he states to be from N. W. to N. by W., with a corresponding easterly dip;" but he elsewhere speaks of the gneiss as running (dipping?) E. N. E. This gneiss often contains beds and disseminated grains of hornblende, and passes in some places into micaceous, chloritic and greenstone slates, and syenite. Staurotide is abundant in the mica schists, and octahedral iron occurs in the chloritic slates. A porphyritic granite containing beryl is also met with in this region. This gneiss is regarded by Dr. Bigsby as belonging "to transition rocks, from its constant proximity to red sandstone, the oldest organic limestone, and trap." (Am. Jour. Sci. (1) viii. 61). The lithological and mineral characters of these crystalline strata seem to be distinct from those of the Laurentian system, and to resemble those of the Appalachians. Too much praise cannot be ascribed to Dr. Bigsby for his early and extensive observations on the geognosy and mineralogy of British North America.

† Am. Journal of Science (2) xxv. 102, 445 xxx. 133; Quar. Journal Geo. Soc. xv. 488, and Can. Naturalist, December, 1859.

* Logan and Hunt, Am. Jour. Sci. (2) xvii. 235.

may then include the Potsdam, Calciferous and Chazy, and thus be equivalent in part to the Quebec group hereafter to be described.

Passing westward into the Mississippi valley we again find a sandstone formation, which forms the base of the palæozoic series, and is considered by Mr. Hall to be the equivalent of the Potsdam. Here it occasionally exhibits intercalated beds of silico-argillaceous limestone, in which occur abundant remains of trilobites of the genera *Dikellocephalus*, *Menocephalus*, *Arionellus*, and *Conocephalus*. Passing upwards this sandstone is succeeded by the Lower Magnesian limestone, which is the equivalent of the Calciferous sandrock of New York, and in Missouri, where it is the great metalliferous formation, alternates several times with a sandstone, constituting the Magnesian Limestone series, which in Missouri attains a thickness of 1300 feet. The same thing is observed to a less degree in Wisconsin and Iowa; throughout this region the higher beds of the Potsdam sandstone are often composed of rounded oolitic granules, and the beds of passage are frequently of such a character as to lead to the conclusion that they have been deposited from silica in solution, and are not mechanical sediments.* For a discussion of some facts with regard to the chemical origin of many silicious rocks, see *Am. Journat of Science*, (2) xviii. 381.

Evidences of disturbance during the period of its deposition are to be found in the brecciated beds, sometimes fifty feet in thickness, which occur in the calciferous sandrock of the north-west, and are made up of the ruins of an earlier sandstone. In Missouri, the Birdseye and Black River limestones repose directly upon the Lower Magnesian limetone, while further north a sandstone intervenes, occupying the place of the Chazy limestone.

The Potsdam sandstone of the St. Lawrence valley, has for the most part the character of a littoral formation, being made up in great part of pure quartzose sand, and offering upon successive beds, ripple and wind marks, and the tracks of animals. Occasionally it includes beds of conglomerate, or as at Hemingford, encloses large rounded fragments of green and black shale; it also exhibits calcareous beds apparently marking the passage to the succeeding formation, which although called a Calciferous sandrock, is for the most part here, as in the west, a magnesian limestone, often geodiferous, and including calcite, pearl spar, gypsum, barytes and quartz. Sir William Logan had already shown that the fauna of the Potsdam and Calciferous in Canada are apparently identical (*Canadian Naturalist*, June 1860, *American Journal of Science* [2] xxxi. 18), and Mr. Hall has arrived at the same conclusion with regard to the more extended fauna of these formations in the valley of the Mississippi, so that these two may be regarded as forming but one group. While in the west *Dikellocephalus* occurs both in the lower sandstones and the magnesian limestones, *Conocephalus minutus*, found in the Potsdam on Lake Champlain, and identified by Mr. Billings, has lately been detected by him in specimens from the sandstones of Wisconsin with *Dikellocephalus*, which genus has there been found to pass upwards into the magnesian limestones. On the other hand, the sandstones of Bastard in Canada, having the characters of the Potsdam, contain *Lingula acuminata* and *Ophileta compacta*, species regarded as characteristic of the Calciferous, together with two undescribed species of *Orthoceras*, and in another locality a *Pleurotomaria* resembling *P. Laurentina*. The researches of Mr. Billings have extended the fauna of the Calciferous in Canada to forty-one species, and the succeeding Chazy formation to 129 species. The thickness of this latter division in the St. Lawrence valley is about 250 feet, and it includes in its lower part about fifty feet of sandstones with green fucoidal shales and a bed of conglomerate. The Calciferous has a thickness ef about 300 feet, while the Potsdam may be estimated at not far from 600 feet.

We have then seen that along the north-eastern outcrop of the great American basin in Canada and New York, the base of the palæzoic series is represented by less than 1000 feet of sandstones and dolomites, reposing directly upon the Laurentian system. A very different condition of things is, however, found in the more central parts of the basin. According to Prof. Rogers, the older Primal slates, which form the base of the palæozoic system, attain in Virginia a thickness of 1200 feet, and are succeeded by 300 feet of Primal sandstone marked by *Scolithus*, which he considers the Potsdam, followed by the upper Primal slates, consisting of 700 feet of greenish and brownish talco-argillaceous shales with fucoids. To these succeed his Auroral division, consisting of sixty feet or more of calcareous sandstone, the supposed equivalent of the Calciferous sandrock, followed by the Auroral limestone, which is magnesian, and often argillaceous and cherty in the upper beds. Its thickness is estimated at from 2500 to 5500 feet, and it is supposed by Rogers to include the Chazy and Black River limestones, while the succeeding Matinal division exhibits first, from 300 to 550 feet of limestone (Trenton), secondly, 300 to 400 feet black shale (Utica), and thirdly, 1200 feet of shales with red slates and conglomerates (Hudson River group), thus completing the Lower Silurian series.

In Eastern Tennessee, Mr. Safford describes (1st) on the confines of North Carolina, a great volume of gneissoid and micaceous rocks similar to those of Pennsylvania, succeeded to the west by (2nd) the Ococee conglomerates and sandstones, with argillites, chloritic, talcose and micaceous slates, and occasional bands of limestone, all dipping, like the rocks of the 1st division, to the S. E. In the 3rd place we have the Chilhowee sandstones and shales, several thousand feet in thickness, including near the summit, beds of sandstone with *Scolithus*, and considered by Mr. Safford the equivalent of the Potsdam. (4th.) The Magnesian limestone and shale group, also several thousand feet thick, and divided into three parts; first, a series of fucoidal sandstones approaching to slates and including bands of magnesian limestone; second, a group of many hundred feet of soft, brownish, greenish and buff shales, with beds of blue oolitic limestone, which as well as the shales, contain trilobites. Passing upward these limestones become interstratified with the third sub-division, consisting of heavy bedded magnesian limestone, more or less sparry and cherty near the summit. The limestones of Knoxville belong to this group, which with the 3rd or Chilhowee group is designated by Mr. Safford as Cambrian, corresponding to the Primal and Auroral of Rogers, or to the Potsdam and Calciferous sandrock, with the possible addition of the Chazy, being equivalent

* See Mr. Hall's Introduction, to which we are indebted for many of these facts regarding the formations of the west, and also the Reports of the Geological Survey of Missouri.

to the great Magnesian limestone series of Prof. Swallow in Missouri. To these strata succeed Safford's 5th formation, consisting of limestones, the equivalents of the Black River, Trenton, and higher portions of the Lower Silurian.

In Eastern Canada we find a group of strata similar to those described by Rogers and Safford, and distinguished by Sir William Logan as the Quebec group. It has for its base a series of black and blue shales, often yielding roofing slates, succeeded by grey sandstone and great beds of conglomerate, with dolomites and pure limestones, often concretionary and having the character of travertines. These are associated with beds of fossiliferous limestones, and with slates containing compound graptolites, and are followed by a great thickness of red and green shales, often magnesian, and overlaid by 2000 feet of green and red sandstone, known as the Sillery sandstone, the whole from the base of the conglomerate, having a thickness about 7000 feet. These red and green shales resemble closely those at the top of the Hudson River group, and the succeeding sandstones are so much like those of the Oneida and Medina formations, that the Quebec group was for a long time regarded as belonging to the summit of the Lower Silurian series, the more so as by a great break and upthrow to the S. E., the rocks of this group are made to overlap the Hudson River formation. "Sometimes it may overlie the overturned Utica formation, and in Vermont, points of the overturned Trenton appear occasionally to emerge from beneath the overlap."* This great dislocation is traceable in a gently curving line from near Lake Champlain to Quebec, passing just north of the fortress; thence it traverses the island of Orleans, leaving a band of higher strata on the northern part of the island, and after passing under the waters of the Gulf, again appears on the main land about eighty miles from the extremity of Gaspé, where on the north side of the break, we have as in the island of Orleans, a band of Utica or Hudson River strata. To the south and east of this line the rocks of the Quebec group are arranged in long, narrow, parallel, synclinal forms, with many overturn dips. These synclinals are separated by dark gray and black shales, with limestones, hitherto regarded as of Hudson River age, but which are perhaps the deep-sea equivalent of the Potsdam.

The presence of conglomerates and sandstones, alternating with great masses of fine shales, indicates a period of frequent disturbances, with elevations and depressions of the ocean's bottom, while the deposits of dolomite, magnesite, travertine and highly metalliferous strata show the existence of shallow water, lagoons and springs over a great area and for a long period between the formation of the upper and lower shales. We may suppose that while the Potsdam sandstone was being deposited along the shores of the great palæozoic ocean, the lower black shales were accumulating in the deeper waters, after which an elevation took place, and the magnesian strata were deposited, followed by a subsidence during the period of the upper shales and Sillery sandstones.

Associated with the magnesian strata at Point Levi and in several other localities in the same horizon of the Quebec group, an extensive fauna is found, of which 137 species are now known, embracing more than 40 new species of graptolites, which have been described by Mr. James Hall in the report of the Geological Survey of Canada for 1857, and 36 species of trilobites described by Mr. Billings in the *Canadian Naturalist* for August, 1860. These species are as yet distinct from any thing found in the Potsdam below or the Birdseye and Black River above; although the trilobites recall by their aspect those found by Owen in the Lower Sandstone of the Mississippi. Seven species alone out of this fauna have been identified with those known in other formations, and of these one is Chazy, while six belong to the Calciferous, to which latter horizon Mr. Billings considers the Quebec group to belong. The Chazy has not yet been identified in this region, unless indeed it be represented in some of the upper portions of the Quebec group. The Calciferous sand-rock is wanting along the north side of the St. Lawrence valley from near Lake St. Peter to the Mingan Islands, but at Lorette behind Quebec, at the foot of the Laurentides, the Birdseye limestone is found reposing conformably upon the Potsdam sandstone.

It is not easy to find the exact horizon of the Potsdam sandstone among the black shales which underlie the Quebec group. The *Scolithus* of Roger's Primal Sandstone, and of the summit of Safford's 3rd or Chilhowee formation is identical with that found in the quartz rock at the western base of the Green Mountains, and figured by Mr. Hall in the 1st volume of the Palæontology. It is distinct from what has been called *Scolithus* in the Potsdam of Canada. The value of this fossil as a means of identification is diminished by the fact that similar marks are found in sandstones of very different ages. Thus a *Scolithus* very like that of the St. Lawrence valley occurs in the sandstone of Lake Superior and in the Medina sandstone, while in Western Scotland, according to Mr. Salter, the two quartzite formations above and below the Lower Silurian limestones of Chazy age are alike characterized by these tubular markings, which are regarded by him as produced by annelids or sea worms. We find however in shales which underlie the Quebec Group at Georgia in Vermont, trilobites which were described by Mr. Hall in 1859 as belonging to the genus *Olenus*, a recognized primordial type; he has since erected them into a new genus. Again at Braintree in Eastern Massachusetts occur the well known *Paradoxides* in an argillaceous slate. These latter fossils Mr. Hall suggests probably belong to the same horizon as certain slaty beds in the Potsdam sandstone, or perhaps even at the base of this formation. (Introduction, page 9.) In this connection we must recall the similar shales of Newfoundland, in which Salter has recognized trilobites of the same genus. These shales containing *Paradoxides*, like those underlying the Quebec group, thus appear to belong to the so-called Primordial zone, and are to be regarded as the equivalents of the Potsdam sandstone, which both on Lake Champlain and in the Mississippi valley is characterized by primordial types. The intermingling of Potsdam and Calciferous forms to which we have already alluded, seems however to show that it will be difficult to draw any well defined zoological horizon between the different portions of these lower rocks, which at the same time offer as yet no evidences of any fauna lower than that of the Potsdam. So that we regard the whole Quebec group with its

* See Sir William Logan's letter to Mr. Barrande, *Canadian Naturalist* for Jan. 1861, and *American Journal of Science* (2) xxxi. 216.

underlying Primordial shales as the greatly developed representative of the Potsdam and Calciferous (with perhaps the Chazy), and the true base of the Silurian system.

The Quebec group with its underlying shales is no other than the Taconic system of Emmons. Distinct in their lithological characters from the Potsdam and Calciferous formations as developed on Lake Champlain, Mr. Emmons was led to regard these strata as belonging to a lower or sub-Silurian group. We have however shown that the palæontological evidence afforded by this formation gives no support to such a view. To Mr. Emmons however is undoubtedly due the merit of having for a long time maintained that the Taconic hills are composed of strata inferior to the Trenton limestones, brought up into their present position by a great dislocation, with an upthrow on the eastern side. We would not object to the term Taconic if used as indicating a subdivision of the Lower Silurian series, but as the name of a distinct and sub-Silurian system it can no longer be maintained. The Quebec group evidently increases in thickness as we proceed towards the south, and the calcareous parts of the formation are more developed. In 1859, I visited in company with Mr. A. D. Hager the marble quarries of Rutland and Dorset, in Vermont. The latter occur in a remarkable synclinal mountain of nearly horizontal strata of marble and dolomite, capped by shales, and attaining a height of 2700 above the railway station at its base. I then identified these marbles with the limestones of the Quebec group, considering them to be beds of chemically precipitated carbonate of lime or travertine, and not limestones of organic origin.

(*To be continued.*

MISCELLANEOUS.

Cotton Manufactures in Canada.

Projects are on foot for the establishment of Cotton Manufactories in various parts of Canada, both in the Upper and Lower Province. A proper conception of the magnitude of our importation of cotton manufactures may be gathered from the fact, that their declared value in 1849 amounted to $4,863,444, or one-eighth of the entire importations of that year.

Table of Importations and Exportations from 1851, *to* 1860, *inclusive.*

	Importations.	*Exportations.*
1851	$21,434,790	$13,810,604
1852	20,286,492	15,307,607
1853	31,981,436	23,801,303
1854	40,529,325	23,019,190
1855	36,086,169	28,188,460
1856	43,584,387	32,047,017
1857	39,428,584	27,006,624
1858	29,078,527	23,472,609
1859	33,555,161	24,766,981
1860	34,441,621	34,631,890

From the foregoing table it appears that the year 1860 is distinguished in Canadian History by being the first year during which the exports exceeded the imports.

Dr. Gesner F. G. S., on Artificial Guano.

Guano, so valuable a fertilizer, is chiefly composed of the excrements of sea fowls. Frequently it contains feathers, bones of fishes, humus, &c. It is very variable in composition, a circumstance that has been ascribed to the different kinds of food upon which the birds subsisted. Some Guanos contain upwards of 25 per cent of uric acid, in others that acid is almost entirely absent, and it is the same in regard to other acids, salts and alkalies. Ammonia usually enters largely into the best qualities of this fertilizer, and the presence of its carbonate is known by its odour. The oxalate, urate and phosphate of ammonia and magnesia are almost always present with the phosphates of soda and lime, the phosphates having been derived from the bones of the fish upon which the birds feed. In the supply of ammonia and of earthly and alkaline salts, guano is of the greatest value for plants cultivated for food. The food of the birds, from which the guano had been deposited has been a certain fish that fed upon other fish, the food of which was marine plants, or animalculæ. The origin of this fertilizer is therefore found in marine plants and animals.

The writer has obtained a product analogous to the true guano, and one nearly, if not quite, equal in its value for fertilizing purposes. Chemical and mechanical means have been applied to the marine *fuci* and fishes and fish offal until an artificial guano has been obtained. The sources of the alkaline carbonate, chloride of sodium and organic matter have been found in marine plants, the phosphate and carbonates of lime and ammonia in the bones and flesh of fishes, and after many experiments carefully performed, they have been combined so as to form a cheap and portable manure. At Long Island, in the State of New York, *menhaden* are manufactured into manure : the oil, which is very offensive, being extracted from the fish and employed for common purposes.

Having visited a great number of the fishing establishments of the Provinces of New Brunswick, Nova Scotia, Newfoundland and the Islands and coasts of the Gulf of St. Lawrence and Labrador, the writer obtained a knowledge of the vast quantity of fish and flesh offal annually thrown into the sea, or otherwise lost to every useful purpose. The garbage thrown-overboard yearly from vessels fishing on the banks of Newfoundland, if properly preserved and manufactured, with the annual growth of sea weeds upon the shore, would fertilize the entire cultivated surface of the Eastern States and British Provinces; still the amount of animal matter thus referred to is far less than that produced by the inshore fisheries.

To the forgoing may be added the enormous quantities of mytili and other shellfish growing upon the shore, and which are not less applicable for the manufacture of artificial guano, than the offal of the finny tribes. At many places on the shores, fish are met with in such abundance that they are employed by the fishermen to manure the small patches of ground some of them cultivate. At the principal fishing stations, the refuse garbage and bones alone would supply a manufactory, and with good management and the use of kelp, the offal may be transported from place to place without inconvenience. Like the bones of terrestial animals, the inorganic matter or ash of the bones of fishes consists in the greater part of the phosphates of lime, or bone phosphate, with carbonate of lime, the fertilizing properties of which are well understood. Few soils preserve their fertility for any length of time. Every crop removes from the earth certain elements, which it is the business of the farmer to restore, and for that purpose no manure is better adapted than guano, either natural or artificial.

Apple Skins.

M. Victor Chatel, who brings forward numerous citations from the most distinguished agriculturists, asserts that wherever apple skins have been employed, either for feeding cattle, or as manure for fields, corn, rape, or young apple trees, the results have been most satisfactory. The skins are preserved by being pressed down tightly in a hole, and covered with a well beaten layer of earth. When cooked and given to pigs, the latter are quickly fattened, and kept in perfect health.

Berthelot—The French Chemist.

The most remarkable scientific event of modern times is the publication of a treatise on chemistry, proceeding on the same plan in organic chemistry as has been adopted for a century past in mineral chemistry; that is, forming organic substances synthetically by combining their elements by the aid of chemical forces only. The author who has performed demonstrations by this method is Berthelot, who has been occupied with organic synthesis since he first devoted himself to chemistry. Berthelot is not a vitalist; he is convinced that "we may undertake to form, *de novo*, all the substances which have been developed from the origin of things, and to form them under the same conditions, by virtue of the same laws and by means of the same forces which nature employs for their formation." Let us hasten to add a distinction upon which Berthelot properly insists and which it is necessary to recognize between organs and the matter of which they are composed. "No chemist pretends to form in his laboratory a leaf, a flower, a fruit or a muscle; these questions relate to physiology;" and it was by not observing this distinction that it was possible to form that school of medicine of which mention was made in my last communication, and which referred everything to vital force. This distinction being admitted, and calling to mind the synthesis recently effected, such as the direct preparation of C^4 H^4 from carbon and hydrogen, and alcohol from the union of C^4 H^4 and water, we may understand the possibillity of performing for organic chemistry what has been done for mineral chemistry, and to give to it a basis independent of the phenomena of life.—*Silliman's Journal.*

The Color of Water.

Dr. Tyndall has shown, by a series of beautiful and conclusive experiments, that water has a decided color —that even in small thicknesses it is not the colorless substance it is usually imagined to be. When seen through a glass full of the liquid, of course it appears without color, but if looked at through a stratum of fifteen fest its color is very evident. The following is Dr. Tyndall's arrangement of the experiment for showing this to a large audience. A tin tube, fifteen feet long and about three inches in diameter, is placed horizontally on a stand, and half filled with water. The tube being about half filled with water, and the image upon the screen being inverted by the lens, the upper air space in the tube is seen in the lower part of the image, which is quite colorless; whilst the upper portion, illuminated by the rays which pass through the stratum of water, is of a greenish blue color. The color varies from a pure green up to a blue, according to the purity or otherwise of the water. Thus it is evident that the color of water is very appreciable; for, in a stratum of fifteen feet, a very considerable amount is exhibited, and thus there is no difficulty in comprehending the fact that, in looking through a deeper stratum, such as is seen in the Swiss lakes and in the water which we have around our own shores, this color of water makes itself very perceptible.—*Scientific American.*

Tanning Statistics.

In a communication to the *Shoe and Leather Reporter*, J. M. Kiersted, jun., states that, during the operation of tanning, conducted for six years at Mongaup, Pa., the average quantity of leather made with one cord of hemlock bark was 145 lbs., and the average cost for tanning 1 lb., was 5c. 92m. The cost of the bark per cord was $3.05. During these six years 92,522 hides were tanned from which 2,988,464 lbs. of leather were made. There were 20,547 cords of hemlock bark used. The leeches for extracting the tannic acid of the bark are heated with steam, and the spent bark is burned for fuel. The expense of tanning with hemlock is continually increasing, as the bark is becoming scarce and the price advancing.

Composition of the Human Body.

Not only does food supply the daily waste of the human body, but, as the body increases in size from birth to adult age, it is supplied with materials for this increase by the aid of food. In order, therefore, to understand the value of food from its composition, it is necessary to know the composition of the human body. Just as any other compound substance can be submitted to chemical analysis and the elements of which it consists ascertained, so can the composition of the human body be discovered. Such analyses of course become difficult in proportion to the complication of the body analysed, and only an approach to the true quantities in which the elements exist can be expected.

The following are the elements and their quantities entering into the composition of a human body weighing 11 stones or 154 pounds:

ULTIMATE ELEMENTS OF THE HUMAN BODY.

	lbs.	oz.	gr.
1. *Oxygen*, a gas. The quantity contained in the body would occupy a space equal to 750 cubic feet	111	0	0
2. *Hydrogen*, a gas. The lightest body in nature. The quantity present would occupy about 3,000 cubic feet	14	0	0
3. *Carbon*, a solid. When obtained from animals it is called animal charcoal	21	0	0
4. *Nitrogen*, a gas. It would occupy, when free, about 20 cubic feet	3	8	0
5. *Phosphorus*, a solid. This substance is so inflammable that it can only be kept in water	1	12	190
6. *Calcium*, a solid. The metallic base of lime, which has not yet been obtained in sufficient quantity to be employed in the arts. It is about the density of aluminium	2	0	0
7. *Sulphur*, a solid. A well known substance. It unites with hydrogen, forming sulphuretted hydrogen, which gives the unpleasant smell to decomposing animal and vegetable matter	0	2	219
8. *Fluorine*, a gas. This substance has not been separated in such a manner as to permit of an examination of its properties, and cannot be exhibited. It is found united with calcium in the bones	0	2	0
9. *Chlorine*, a gas. When combined with sodium it forms common salt	0	2	47
10. *Sodium*, a metal. It is so light that it floats on water, and is kept in naphtha to prevent its oxidation	0	2	116
11. *Iron*, a metal. In small quantities it is necessary to the health of the body	0	0	100
12. *Potassium*, a metal. Like sodium it floats on water, and burns with a flame when placed on it	0	0	290
13. *Magnesium*, a metal. Combined with oxygen it forms magnesia	0	0	12
14. *Silicon*, a metallic substance. With oxygen it forms silex or silica. It enters into the composition of the teeth and hair	0	0	2
	154	0	0

Other elements have been found in the body, as copper and manganese, but these are probably accidental.

These elements, when combined together, form a set of compound bodies called "proximate principles," out of which the tissues and fluids of the body are formed.

PROXIMATE PRINCIPLES OF THE HUMAN BODY.

	lbs.	oz.	gr.
1. *Water*, composed of oxygen and hydrogen gases	111	0	0
2. *Gelatin*, of which the walls of the cells and many tissues of the body, as the skin and bones, are principally composed	15	0	0
3. *Fat*, which constitutes the adipose tissue	12	0	0
4. *Phosphate of Lime*, forming the principal part of the earthy matter of the bones	5	13	0
5. *Carbonate of Lime*, also entering into the composition of bone	1	0	0
6. *Albumen*, found in the blood and nerves	4	3	0
7. *Fibrine*, forming the muscles and the clot and globules of the blood	4	4	0
8. *Fluoride of Calcium*, found in the bones	0	3	0
9. *Chloride of Sodium*, common salt	0	3	376
10. *Chloride of Potassium*	0	0	10
11. *Sulphate of Soda*	0	1	170
12. *Carbonate of Soda*	0	1	72
13. *Phosphate of Soda*	0	0	400
14. *Sulphate of Potash*	0	0	400
15. *Peroxide of Iron*	0	0	150
16. *Phosphate of Potash*	0	0	100
17. *Phosphate of Magnesia*	0	0	75
18. *Silica*	0	0	3
	154	0	0

These compounds, in passing away from the body, form many others, which may be here left out of consideration as not forming a necessary part of the fabric of the human body.

None of these constitutents of the body remain permanently in the system, and whilst the old particles are being removed new ones are supplied by the food. It is calculated that in this way a quantity of material, equal to the weight of the whole body, is carried away every forty days. So that we may be said to moult or cast away our old body and get a new one every forty days.

The materials for the food of man, and containing the above elements, are derived from the mineral, vegetable and animal kingdoms. The vegetable kingdom, however is the great source of food to man and animals, as it is in the cells of the plant that the elements undergo those chemical changes which fit them for food. The animal can only supply what it obtains from them, and the substances supplied by the animal kingdom as food are identical with those obtained from plants. To a certain extent the physiological action of food depends upon its chemical composition.—*Guide to the Food Collection of the South Kensington Museum.*

New Zealand Steel.

The occurrence of Titaniferous ores of iron in Canada is well known. Sir W. Logan has long since pointed out their distribution at St. Urbain (Baie St. Paul) and Vaudreuil (Beauce). The following notice of the Titaniferous ores of New Zealand will serve to direct renewed attention to the Canadian deposits of this important material:

Ever since the settlement of New Zealand by Europeans their attention has been daily called to the peculiarities of a kind of metallic sand along the shores of New Plymouth, in Taranaki. This sand has the appearance of fine steel filings, and if a magnet be dropped upon it, and taken up again, the instrument will be found thickly coated with the iron granules. The place where the sand abounds is along the base of Mount Egmont, an extinct volcano; and the deposit extends several miles along the coast, to the depth of many feet, and having a corresponding breadth. The geological supposition is that this granulated metal has been thrown out of the volcano along the base of which it rests into the sea, and there pulverized. It has been looked upon for a long time as a geological curiosity, even to the extent of trying to smelt some of it; but, although so many years have passed since its discovery, it is only recently that any attempt has been made to turn it to a practical account; in fact, the quantity is so large that people out there looked upon it as utterly valueless. It formed a standing complaint in the letters of all emigrants, that when the sea breeze was a little up they were obliged to wear veils to prevent being blinded by the fine sand which stretched for miles along the shore. Captain Morshead, resident in the West of England, was so much impressed with its value that he went to New Zealand to verify the reports made to him in this country, and was fortunate enough to find them all correct. He smelted the ore first in a crucible, and subsequently in a furnace; the results were so satisfactory that he immediately obtained the necessary grant of the sand from the Government, and returned to England with several tons for more conclusive experiments.

It has been carefully analysed in this country by several well-known metallurgists, and has been pronounced to be the purest ore at present known: it contains 88·45 of peroxide of iron. 11·43 of oxide of titanium, with silica, and only 12 of waste in 100 parts. Taking the sand as it lies on the beach and smelting it, the produce is 61 per cent. of iron of the very finest quality; and, again, if this sand be subjected to what is called the cementation process, the result is a tough, first-class steel, which, in its properties, seems to surpass any other description of that metal at present known. The investigations of metallurgical science have found that if titanium is mixed with iron the character of the steel is materially improved; but, titanium being a scarce ore, such a mixture is too expensive for ordinary purposes. Here, however, nature has stepped in, and made free gift of both metals on the largest scale. To give some idea of the fineness of this beautiful sand, it will be enough to say that it passes readily through a gauze sieve of 4900 holes or interstices to the square inch. As soon as it was turned into steel by Mr. Musket, of Coleford, Messrs. Moseley, the eminent cutlers and toolmakers, of New-street, Covent-garden, were requested to see what could be done with the Taranaki steel. They have tested it in every possible way, and have tried its temper to the utmost; and they say the manner in which the metal has passed through their trials goes far beyond anything that they ever worked in steel before. It has been formed into razors, scissors, saws, penknives, table cutlery, surgical instruments, &c.; and the closeness of the grain, the fineness of polish, and keenness of edge, place it in the very foremost rank—almost in the position of a new metal.

Some silk-cutting tools have been made, and so admirably have they turned out that one particular firm will in future use no others. In the surgical instruments the edges have been examined by the microscope, and have stood the test in keeping the superiority. This steel is stated to possess peculiar advantages for gun-barrels and boring-cutters for ordnance purposes. As far as is at present known of this extraordinary metal, it bids fair to claim all the finer classes of cutlery and edge-tool instruments to itself, so well has everything made from it turned out. Messrs. Moseley, in whose hands the sole manufacture of cutlery and edge-tools is vested for this country, have placed a case, filled with the metal in all its stages, in the Polytechnic Institution. There is the fine metallic sand, some beautiful specimens of the cutlery made from it, and the intermediate phases of the iron and steel.—*The Australian Mail.*

The Cotton Supply.*

There are, as far as my information extends, but two countries that are likely to furnish us with a fair supply of good cotton, and this not in substitution of the cotton of America, but as considerable auxiliaries to it. These are our recently acquired territories on the eastern side of the Bay of Bengal, including Arracan, Pegu and Martaban, but excluding those on the Tennerasim coast, and the lately formed colony of Queensland in Australia. I shall describe the little I know of them.

Our territories on the eastern coast of the Bay of Bengal embrace four degrees of latitude extending from the 16th to the 20th degree, and contain an area of 64,450 square miles, or are larger than England and Wales by at least 10,000 miles. Their scanty population ranges from 8 to 50 inhabitants to a square mile, or on an average about 26, not one twentieth part of the average density of the population of lower Bengal. The country is watered by one great river and three considerable ones, each with branches and affluents, forming an extensive network of internal boat navigation, so that the territory, on a minor scale, bears no inconsiderable resemblance to that of the Lower Mississippi. The coast has at least four safe harbours to which there is inland communication by water. The greater portion of the country is a rich alluvial plain, producing as before stated, by far the largest amount of the rice which is exported from British India under the name of "Bengal," a commodity of which we ourselves imported in 1859, about 64,000 tons of the value of £686,000, forming 88 parts in a 100 of all of that grain which we imported.

The wild or unoccupied land must, of course, from the sparseness of the population, be large, and there ought to be no more difficulty in obtaining the fee-simple of it by Englishmen, than there is in Canada or Australia. This would be a necessary preliminary to the production of good cotton. If the local population —a very docile one—were not found sufficient for the requisite labour, the exuberant population of India is close at hand to make up the defficiency. The periodical rains of great severity, extend from April to September, and during their continuance, the cultivation of cotton could not be carried on. Sown in March, however, the crop would have six months of dry weather to ripen, which, it may be presumed, would suffice. A rice crop, in this case, would occupy the land during the rains, so that there would be a cereal and a cotton crop within the year. I resided for some time in the country I am now giving an outline of, and the impression which my acquaintance with it has left is, that it seems better adapted to the culture of the cotton plant than any other part of India. Experience alone, however, must be the only test of its practical adaptation.

Of Queensland we know, as yet, far too little to enable us to speak confidently of its capacity to produce cotton. It is described, however, as having a fertile soil with sufficient moisture, and to possess some commodious harbours. It certainly lies within latitudes (that is from the 30th degree south to the tropic), corresponding with those parts of Brazil which produce cotton superior to the average of American. Should Queensland be found adapted to the cultivation of cotton, the heat of the climate will necessitate Asiatic-labour, and this may be obtained from India, as in the case of Ceylon and the Mauritius, or from China, equally ready to yield it, and indeed, yielding it already largely to Australia in the case of the gold mines.

From the facts which I have adduced in the course of this paper, I must come to the conclusion that there exists no reasonable ground for apprehending any serious deficiency in our supply of cotton, although in cotton, as in every other product of the soil, fluctuations must be expected which no care can obviate. Our chief reliance, must long, in my opinion, be on Anglo-Saxon America, which at present furnishes us with four-fifths of the value of all that we consume. This mere name, however, does not imply that we receive the whole from a single country, for no fewer than seven sovereign states, each as large as an European kingdom, contribute to our supply,—all, too, competing with one another to make that supply as cheap, good, and abundant as possible.

The integrity of the cotton manufacture is indispensable to our prosperity, but the cultivation of the plant is, if possible, of still more vital importance to the Southern States of America. We derive our chief supply from them, and we are by far their best customers. There exists between us, consequently, a mutual and profitable dependence, which promises a long duration. If other countries can supply us with better cotton than America, our market, the best in the world, is free to them, and no doubt they will furnish it, but it does not appear to me that we are called upon to make extraordinary or eccentric efforts to insure it, any more than we are to insure a supply of corn or any other staple article of our consumption. In a struggle of seventy years, the Southern States of America have, in a great measure, succeeded in driving all other competitors out of the market, leaving to the rest of the producing countries but a small fraction of our consumption. To save themselves from their overpowering competitors, the tropical countries have betaken themselves to the culture of the sugar-cane and coffee, in the production of which they have the same advantage over the Southern States of America that these have over them in the culture of cotton.

* Extract from a paper read before the Society of Arts, by John Crawford, F.R.S., late governor of Singapore.

ERRATUM.

In the April number of the Journal, page 86, 2nd column, eighth line from the bottom, for "*imago* state," read "*pupa* state."

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

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THE PETROLEUM, OR ROCK OIL OF CANADA.

No. III.

In the February and March numbers of this Journal attention was drawn to the new branch of industry growing into activity in the township of Enniskillen and elsewhere in the western part of Upper Canada. During the last month, the writer of this descriptive notice has had an opportunity of visiting the Springs and works in operation at Petrolia, and of accumulating a variety of information on the subject, which may be found useful to those who are desirous of engaging in the oil enterprise, or who are interested in its progress and development. Although the results of the enquiries which have been made do not tend to change in any material point the opinions already expressed in this Journal, as far as regards the oil wells of Enniskillen, yet it may be found that the facts which have been recently brought to light will extend the area over which Petroleum may be sought for with valuable results, and give a proper direction to further efforts in search of this useful product, where it may be supposed to exist in remunerative quantities.

History of the Springs—Geology of the Oil Region.

The existence of bituminous springs in Canada has been long made known to the public by the labors of the Geological Commission. In the year 1851, Mr. Murray included in his report for that year a brief notice of the *mineral caoutchouc* of the Western Peninsula, and pointed out the existence of the bituminous springs and beds of bitumen in the township of Enniskillen. The report for the year 1851-52, which contains this notice, being in the hands of private individuals or locked up in the appendices to sessional papers, it is not likely that its contents are widely known, we therefore introduce the following extract, which will suffice to show that the bituminous springs of Enniskillen were well known and briefly described in published documents ten years ago. It is necessary to remind the reader who may be familiar with the geology of Canada, that, during an exploration made in 1855 by Mr. Murray, the supposed black shales at Kettle Point, L. H., were ascertained by him and Mr. Hall to belong to the superior formation, known by the name of the Portage and Chemung group. An extract from Mr. Murray's report for 1855 will exhibit the area which these rocks are supposed to occupy.

"The black shales of the Hamilton group, in the Western Peninsula, are in general probably more bituminous than those of the Utica slate. Several places in their distribution are characterised by bituminous springs, and a visit was made in the early part of the season to a bed of nearly pure bitumen, of which the existence has been noticed in previous Reports, including that of last year, in which the range of the Hamilton group in the Western Peninsula is given. This bed of bitumen, which in some parts has the consistency of mineral caoutchouc, occurs on the sixteenth lot of the second concession of Enniskillen in the county of Kent, but its extent does not appear to be so great as we were at first led to understand. It does not seem to exceed half an acre, extending five chains in a north-east direction, with a breadth of rather less than half a chain. By different trial holes which have been sunk through the deposit, it would appear to have a thickness of two feet over about twenty feet square, towards the south-west end, from which it gradually thins towards the edge in all directions, varying in some parts along a low ridge which it forms, from a foot to four inches. The bitumen is underlaid by a very white clay, which I was informed had been bored through in one part for thirty feet. The upper portion of the clay was observed to be more or less penetrated with petroleum, and small black globules of the same were seen scattered through the mass for a depth of four or five feet. Bituminous oil was observed to rise to the surface of the water on the Black Creek, a branch of Bear Creek, in two places on the seventeenth lot of the third concession of Enniskillen, and I was informed that it had been observed at other parts further down the stream, but to what amount the material might be daily collected at any of the places, I am quite unable to say; a freshet prevailed in the river at the time of my visit, the current of which swept away the oil as fast as it rose."

The following extract from Mr. Murray's report for 1855 contains a short description of the geology of the Western District, which will be found very useful in an attempt to trace the origin and extent of the oil springs of the Western Peninsula.

"In my reports of 1848–49, and 1850–51, the black bituminous shales which were observed at Kettle Point, on Lake Huron, and at the flour mills, on the Sydenham River, are described under the head of the Hamilton formation. The shales in those instances are either altogether destitute of organic remains, or hold only forms of plants and obscure shells of species not then described, and being in each case immediately underlaid by beds of limestone, in which *spirifer mucronatus* and other characteristic fossils of the Hamilton group are abundant, it was inferred that the shales belonged to the group. Mr. Hall, however, on seeing the section at Kettle Point, expressed it as his opinion that the rocks were the lowest measures of the Portage and Chemung group, and this opinion was further confirmed by our subsequently finding a nearly complete section of the Hamilton group on the banks of some of the tributaries of the River Sable (south), shortly afterwards, on the twenty-fifth lot of the third range of Bosanquet. On the banks of a small tributary of the Sable,

the following section was measured in ascending order:—

		FEET.
1.	A slope or talus over the stream	25
2.	Grey calcareous shales with *spirifer mucronatus* and numerous fossils	4
3.	Bed of compact encrinal limestone	2
4.	Soft shales, thinly laminated next the limestone, filled with fossils, among which *Cystiphyllum cylindricum* (Halls Rep. 4th Dist. N. Y.) is very abundant; the upper part decomposes into a clay, and fossils are found in the decomposed edges	20
5.	Decomposed shale or clay, not well exposed	80
6.	Grey encrinal limestone, weathering into small lenticular fragments, and holding bivalve shells, corals and encrinites	2
		133

"At Jones' mill, on the third lot, south boundary of Bosanquet, on the bank of a small tributary of the Sable, another section is exposed, which in ascending order, is as follows:—

		FEET.
1.	Brownish grey-weathering shales, holding *spirifer mucronatus* in great abundance, and a few other bivalves and corals	25
2.	Encrinal limestone	2
3.	Decomposing shale, with *Cystiphyllum*	3
		30

"At Austin's mill, on the fourth lot of the first range of Bosanquet, on another small creek, there is a corresponding section, where the encrinal limestone which forms the uppermost layers of the exposed strata, is about five feet thick. Below the encrinal limestone, the shales are characterized as at the other places by a profusion of *spirifer mucronatus;* and in the bed of the creek at a level probably about fifty or sixty feet lower than the upper limestone bed, there is a band of hard and compact arenaceous limestone, about seven inches thick, underlaid by black shales holding *Atripa*, *Leptœna*, and *Chonetes*.

"The overlying bituminous shales of the Portage and Chemung groupwere found at two localities not observed previously; one in the bed of a stream supposed to be the north branch of Bear Creek, near Kingston's Mills, on the seventh lot of the third range of Warwick; and the other at Branon's mills, on the twentieth lot of the seventh range of Brooke, in the bed of the east branch of Bear Creek. In each of these instances the shales are characterized by spherical concretionary calcareous nodules and masses, as at Kettle Point: but with the exception of some rather obscure scales of fish, which were found at the exposure in Warwick, no fossils were discovered at either place. The debris of the Hamilton shales with *spirifer mucronatus*, *Atrypa* and corals, were found abundantly among the drift; and large masses of the encrinal limestone lay at the bottom of the creeks, and in the surrounding country.

"In my Report of 1848–49, the clays of the town ship of Plympton, on the shore of Lake Huron, are described under the head of Drift, and the fossils in the limestone pebbles are represented as those peculiar to the Corniferous formation; a comparison of the Plympton fossils with the collection of the present year however tends to show that the clays and organic remains in the limestone are derived from the ruins of the decomposing shale of the Hamilton group, while the pebbles of quartz, granite, and altered rocks, are portions of the lake drift. It appears highly probable that a large portion of the clay country in the neighbourhood of Chatham, and at the mouth of the Thames, takes its argillaceous character from the same source, and that the limestone formerly mentioned, but not yet examined, which occurs in Harwich, belongs to one of the beds of encrinal limestone of the Hamilton formation.

"The result of the evidence thus obtained leads to the conclusion that the trough or belt of the Hamilton formation, running across the peninsula, is considerably broader than previously represented, and that it contains near its centre, one and probably two outlying patches of the superior formation; because if it be admitted (which is most probably the case) that the asphaltic deposits and the petroleum springs of Bear Creek in Enniskillen on the one hand, and the petroleum springs of the Thames in Mosa on the other, take their origin from the bituminous shales of the Portage and Chemung group, the lower formation protrudes through, and probably divides the shales at Smith's mills, on the Sydenham River, in the township of Euphemia, as described in my Report of 1850–51, where the prevailing fossil is *spirifer mucronatus*, which at the time I wrote that Report, I supposed to be identical with a very similar species, peculiar to the Corniferous limestone.

"The absence of exposures of the older strata, in consequence of the great thickness of the drift deposits through the western region, renders it very difficult to give a perfectly accurate outline of the various boundaries of the formations; judging however from the facts above stated, together, with others previously mentioned in other Reports, it is probable that the eastern outcrop of the Hamilton formation commences on Lake Huron, near the town line, between Stephen and Hay, and then runs southerly, parallel to the Sable River, through McGillivray, Williams, Adelaide and Caradoc; thence bending easterly, it crosses the Thames near Munsey Town, and afterwards holds an easterly course towards Long Point, parallel with Lake Erie. The western outcrop may be supposed also, from data given in former Reports respecting the distribution of the Corniferous limestone, to run across from Lake St. Clair, somewhere near the mouth of the Thames, through East Tilbury and Raleigh, towards the Rondeau on Lake Erie.

An inspection of the geological map of Western Canada, by Sir W. E. Logan, accompanying a paper on the *Physical Structure of the Western District of Upper Canada*, published in the *Canadian Journal*, August, 1854, 1st Series, will show that the trough or depression mentioned by Mr. Murray, occupies that part of the peninsula which is intersected by the Thames, Black Creek and Bear Creek, the transverse axis of which probably passes through the townships of Chatham, Camden, Dawn and Zone, with a north westerly and south easterly extension towards Lakes Huron and Erie. It is in the rocks occupying that depression, consisting of the black bituminous Hamilton shales, overlaid in patches by the Portage and Chemung group, that the oil appears to have accumulated in fissures or crevices.

The whole of the western peninsula portion of the province has been subjected to a very considerable

but gentle upheaval and subsequent denudation. The rocks may be fissured to a much greater extent than appears any where in those exposures which have been recognized and described. The general aspect of the rock, as far as observed, does not lead to the conclusion that these fissures are very extensive or numerous. Too little is known respecting the direction they preserve to warrant any genera rules being given for boring, in the hope of penetrating a fissure. When the country is properly mapped, the productive and non-productive wells accurately laid down, it is not improbable that the general direction of the fissures may be ascertained, and then boring will be prosecuted in conformity with these valuable guides, which are much more likely to produce favorable results than the blind attempts which are often made with no other foundation for success than a hope that oil may be struck. The following extract is from Sir William Logan's paper, before referred to, which should be studied in connection with the more recent examination of the country by Mr. Murray, the results of which are given in preceding paragraphs, and tend to show that the trough occupied by the rocks of the Hamilton and Portage groups covers a much wider area than was supposed when the first preliminary examination of the country was made many years ago.

"Taking these rocks in their general groupings it will be perceived by the map that the Lower Silurian series, by a change in the strike from west to north-west, sweeps round from Lake Ontario to Georgian Bay, and proceeds thence by the north side of the Manitoulin Islands, and the north shore of Lake Huron, to the northern peninsula of Michigan, gradually curving to Green Bay, in Lake Michigan. The Upper Silurian follows them. The Niagara Limestone at the base aids in forming the neck of land separating and holding up Lake Erie from Lake Ontario, and continues in a ridge along the Blue Mountains, and the promontory terminating at Cabot's Head and Cape Hurd, of which promontory the chain of the Manitoulin Islands is only an interrupted prolongation. The Gypsiferous rocks succeed conformably, running from Grand Island, by the Welland and Grand Rivers, to the River Sauguine, while the superimposed Corniferous Limestone, from Lake Erie on the one side and Lake Huron on the other, is projected forward into the Western District as far as the Township of Zone. The same formation, with a projected form in an opposite direction, comes up from Ohio by the upper end of Lake Erie, and is carried north-easterly as far as the eastward side of Chatham. Between Zone and Chatham, the Hamilton group, composed of black bituminous shales, constitutes a narrow band, which runs north-westward towards Lakes Huron and St. Clair, and south-eastward to Lake Erie, gradually widening in both directions in the surface it occupies, and finally merging into two rings, or irregular circular belts, one of which is rudely concentric with the coal measures of Michigan, and the other with those of the Appalachian field—of which last, however, the map shows but a small portion. Within these two rings, thus united by the band across the Western District, and between them and the Carboniferous centres, the Chemung and Portage groups occupy their place, in two broad and entirely separate zones, one of them showing itself north-west of Lake St. Clair, and the other south-east of Lake Erie.

"To any one accustomed to consider the forms derived from the intersection of surfaces, who will carry in his mind that the various formations which have been given are nothing more than a set of thick, close fitting, conformable sheets, which are intersected by the general surface of the country, it will be at once apparent that the ascertained geographical distribution of the formations results from the fact that between the Michigan and Appalachian coal-fields there is *a flat anticlinal arch*, the axis of which runs, with a gentle curve, from the upper extremity of Lake Ontario by London, Zone, and Malden, to the Maumé River, at the upper end of Lake Erie, and that between Chatham and Zone there is in it a *slight transverse depression.*"

Supposed Antiquity of the Wells.

The explorations which have been made at the new village of Petrolia, on the 13th lot of the 10th concession, and the 13th of the 11th concession of Enniskillen, lead to the supposition that the natural oil spring which now bears the name of Bligh's Well, or the Indian Well, was known to the Aborigines long before European settlers came to the country, and the oil or petroleum issuing from it was used by them for medicinal purposes. It is stated by Indians who hunted in that part of the country fully 50 years ago, that not only do they remember employing the oil as a great medicine in the vapour bath, so much used by the Aborigines, but from traditional accounts they believe it was so used by their ancestors from very remote periods. In a recent excavation at the Indian Well, which is situated in the flats or valley of Bear Creek, the workmen passed through six feet of alluvial clay, they then came to what had once been apparently a circular excavation five feet in diameter, uniformly round, and full of gravel, deer's horns, fragments of oak bark and wood, the whole glued or cemented together by petroleum. At the depth of thirty-five feet from the surface, the circular form of the supposed former excavation changed to that of an oblong, about four feet by two, with a slight bend at one end, the oil or petroleum then broke in upon the workmen and arrested further progress. The sides of the well, as it may be termed, were burned or calcined and traversed by cracks, as if it had once been subjected to great heat, such as might be supposed to arise from the long continued combustion of the oil and light carburretted hydrogen, which issues in abundance from this and other natural oil wells. It is also stated that fragments of Indian pottery were found in the Indian well, but this statement has not been traced to authority upon which perfect reliance can be placed.

The occurrence of fires in the highly bituminous rocks of the Western Peninsula is a well known fact, and one observation rests upon the excellent authority of Mr. Murray, who witnessed this phenomenon at Kettle Point, in 1848. The whole beach, where the bituminous shales occur, is described to have presented the appearance of having been overrun by fire, which the Indians assert had continued to burn for several consecutive years. On digging a foot deep or more into the shingle at Kettle Point, Mr. Murray observed a faint and almost colourless vapour arise immediately from the opening, which, gradually increasing in volume and density, became in the space of two or three minutes a distinct smoke, emitting an odor very similar to that produced by the combustion of a sulphurous coal, and evolving at the same time a considerable heat.* The shingle of the beach is of a bright red colour wherever the fire has extended, the bituminous matter having entirely disappeared.

Natural Oil Springs in the Western Peninsula,

Petroleum or Rock Oil has been observed to issue from the surface of the soil in the following localities, and it is consequently in the neighbourhood of these natural springs that the most extensive operations are in progress to obtain the coveted product.

1. Donnellson's Spring, 3rd con. Enniskillen.
2. Pike's Spring, " "
3. The Fountain Spring, 2nd " "
4. The Bligh or Indian Spring, 10th " "
5. Cooke's Spring, 11th " "
6. The Three Holes on lot 20, 13th " "
7. The Mosa Springs, on the 28th and 29th lot of the 1st concession of Mosa.
8. The Burne Springs, at Tilsonburg, near Ingersoll.

It is highly important to notice, as bearing upon the origin of these natural springs, that while the source of the first seven mentioned in the above list is apparently the bituminous shales of the Portage and Chemung group, the rock from which the Tilsonburg Spring in the township of Dereham arises, is unquestionably of the age of the Corniferous limestone. The importance of this fact will become more apparent when we consider the geological formation of the country between lakes Huron and Erie, and the large area of country occupied by the Corniferous Limestone.

At the Three Holes on 13th con. of Enniskillen, three natural depressions are visible, one of them, the largest, being about 100 feet long, 6 feet wide, and about 8 feet deep. Light carburretted hydrogen is continually bubbling through the water which occupies them in the spring of the year.

* Report of Progress in 1848-49.

The Tilsonburg Spring, coming from Corniferous limestone rock, is of special interest. When first observed, water and oil were seen issuing from the same orifice, and, on sinking about 13 feet through a black miry clay, the workmen came to a large horn about seven feet long and twelve inches in circumference. Making every allowance for exaggeration, it is not unlikely that this horn may be of considerable scientific interest; and if reliance is to be placed upon the brief description given above, it will be at once seen that it characterizes the horn of an extinct animal whose remains have been found elsewhere in the drift of Canada. After a further excavation of eight feet, or twenty-one feet in all, the men came to a deer's head and horns, almost in a state of petrifaction, with the tines partially worn away. These, like the horn before described, were thrown into the stream close at hand to be washed, but were soon forgotten. Steps have been taken to procure these interesting remains if still in existence and accessible, when they will be subjected to a proper examination, and the species of animal to which they probably belonged determined. When first commencing the excavation, the workmen at Tilsonburg observed two small holes at the surface, which increased in size as they penetrated deeper into the earth, and when 26 feet below the surface they had the form of an L, and were packed in the centre with fragments of vegetable matter cemented together with inspissated bitumen, water and oil issuing continually through the unobstructed part of the tubes. The well yielded, when the workmen first struck the oil, on the 11th May of the present year, about 60 gallons in the course of the day.

The Oil Wells in Enniskillen,

During the six months which have elapsed since public attention was first called to the oil springs of Enniskillen, about 86 wells have been sunk. Arrangements were in progress, chiefly by Americans, for sinking four or five times that number at the commencement of the present year, but the sudden stagnation of every kind of enterprise, produced by the American revolution, has led to the abandonment for the present of many contemplated sinkings and borings, so that the present condition of the oil industry in Enniskillen cannot be taken as any guide to the probable degree of importance which that industry would have attained, even at the present time, if the disastrous influence of civil war had not suddenly arrested the progress of numerous contemplated works. The number of wells known to be yielding oil to an extent varying from two to twelve barrels a day does not exceed eleven. From the most reliable sources, it appears to be certain that not more than 13 per cent. of the wells are yielding any return of oil to their proprietors, and out of this

small per centage not more than four or five yield twelve barrels a day, of 42 gallons to the barrel.

All the prolific wells have been sunk in the valley of Bear or Black Creek, but attempts are now being made to obtain oil from wells sunk in the upland, which is about 50 feet above the surface of the valley of Bear Creek in the neighbourhood of Petrolia, on the 13th lot of the 10th and 11th concessions. The wells on the upland would have to be excavated in some places to the depth of at least 90 feet, before the rock is reached, that being the apparent average thickness of the drift near Petrolia, according to the following measurement.

Mean depth of Valley of Bear Creek below the Upland	50 ft.	0 in.
The Collner Well—		
Yellow clay	14	0
Blue clay	23	0
White clay	7	0
Gravel	0	6
Rock	0	0
Total	94 ft.	6 in.

The *London Free Press* states that,

"At 12 o'clock on Friday last, the new well of Mr. L. L. Collner, on the Bligh farm, lot 13, 10th concession, Enniskillen, when at the depth of 53 feet, suddenly broke in, with a tremendous rush of oil, filling the well to the depth of 45 feet with pure surface oil, now selling at Wyoming station for 15 and 20 cents per gallon."

The event must have occurred a few hours after the writer had visited the Collner Well. At eleven on Friday, 10th, 'signs of oil' were beginning to be perceived, and it was then expected that oil would be 'struck' in the course of the day.

The depth of the drift is not generally 90 feet on the upland. A boring was commenced on the 10th May in the 8th Concession, and a depth of 44 feet attained before nightfall. The auger having passed through clay with a trifling admixture of pebbles, but not sufficient to retard the operation. On the following day a depth of 66 feet 6 inches was reached, and the surface of the rock touched. Five feet six inches of the drift above the rock consisted of a "black gravel," most probably derived from the ruins of the subjacent bituminous shales. No signs of oil appeared when the borer touched the rock. It is in contemplation to penetrate the rock to a considerable depth, the result being anxiously looked for by many enterprising "oil-men."

Close to the Collner Well are two wells yielding large quantities of oil, which, together with the water, is pumped out by steam power. The oil and water are received into large square wooden tanks, provided with a partition, so that as the liquid rises in one compartment to the level of the partition, the lighter oil flows over and is received free from water in the second compartment. At the wells in question, the steam engine is placed between them and about 50 yards from each, the pumping gear being connected with the engine by means of shafting on timber supports.

A well may be sunk within a few yards of another yielding a continuous flow of oil without showing any sign of the presence of that fluid. From this fact it appears tolerably certain that the oil is contained in fissures and cavities in the subjacent rock, which may be sufficiently extensive in their ramifications as to produce an abundant supply for a long period of time, or they may on the other hand be rapidly exhausted. Instances have already occurred of wells giving a fair yield of oil for some weeks and then becoming dry. It is not improbable that where wells derive their supply from the same fissure or spring, that a greater drain upon one will exhaust its neighbour. This has occurred in the United States, and it has become no uncommon artifice for an enterprising 'oil man' to put up a steam engine of double or treble the power of those used by his neighbors, and, by sinking his well a few feet lower, draw from the wells around him the supply of oil which they formerly yielded. The presence of water in large quantities in the well operates as a serious drawback to their productiveness, but at the same time it affords a collateral proof that the oil is contained in fissures traversing the rocks at different levels. Experience shows that eight feet of water in one of the most prolific wells diminishes the yield to the extent of at least 30 per cent. This may probably be explained upon the supposition that the source of the oil is an irregular undulating fissure, occupying throughout its course different levels. An accumulation of water in a well raises by hydraulic pressure the water and oil in the fissure from which it derives its supply; the oil being the lighter body floats on the surface, and cannot pass to the well in quantity until the water has been drawn off and permits a passage through the undulating crack. For the same reason it is evident that the chance of striking a vein of oil is altogether uncertain; hence there is reason to suppose that profitable results may be obtained by boring in the upland, as well as in the bed of the river, although the latter appears at present to afford the best prospect of success, as it is not improbable that the course of the streams have been determined in some localities by depressions in the rock not wholly obliterated by the drift which covers the country, and in such depressions the oil has probably accumulated during the lapse of ages.

The artifices employed to prevent an inconvenient quantity of water from mingling with the oil in the well is both simple and ingenious. It is applicable, however, in those cases only where the oil is found

to enter the well through a fissure. A hole is drilled about two feet below the vein, the bottom of the pump is plugged, and feed holes are bored in the side of the tube, two feet from the extremity. Below and above the feed holes, two leather bags containing linseed or peas are fastened to the tube, the extremity of which is then inserted into the drill at the bottom of the well, and the feed holes turned opposite to the vein. The bags with peas or linseed are adjusted round the tube, above and below the vein, and packed or puddled as tightly as possible. Water slowly permeates the leathern bag, swells the peas or linseed, and so fills the drill that neither water or mud from above or from below can enter the feed holes of the pump in sufficient quantity to interfere with the operation of pumping out the oil. A second pump is introduced for the purpose of drawing off the water above the vein, if it accumulates in quantity sufficient to arrest the flow of the oil in the manner explained in preceding paragraphs.

Properties of the Oil—Its Cost.

No one who has once been in the neighborhood of a barrel of the Enniskillen oil will be disposed to renew his acquaintance with its odour without some special inducement. In cold weather the smell is not oppressive, nor in fact particularly disagreeable, but when the sun shines for a few hours upon an assemblage of barrels full of this odoriferous fluid, the stench must be intolerable to unaccustomed nostrils not rendered insensible by the spirit of enterprise or the desire of gain. Three hundred barrels of Enniskillen oil were exposed on an open platform at the Wyoming Station in the second week of May, and if no protection is afforded during the hot summer months, the odour will probably be any thing but agreeable.

A barrel of the oil containing 42 gallons, weighs 365 lbs.; the weight of the barrel varies from 60 to 85 lbs., according to the extent to which the wood has absorbed oil. The weight of a gallon of crude oil is about 7½ lbs.; but as the character of oil from different wells varies, its specific gravity cannot be exactly stated. A gallon of water weighs 10 lbs.; if therefore the weight of the same measure of oil be assumed as above, its specific gravity will be about 73, water being 100. The purified oil is now extensively used as a medicinal agent, even by educated and experienced practitioners. Among the oil men at Enniskillen it is considered a grand specific. The occupations connected with the collecting and handling of this substance are stated to be singularly healthy, and many are willing to bear testimony that they have enjoyed better health during their labours at the oil wells than at any previous period of their lives. The process of refining the oil for economical purposes is yet in its infancy. Distillation at low temperatures appears to be absolutely necessary in order to secure the largest proportion of available illuminating fluid. Oil of vitriol, soda, and bi-chromate of potassa, for the purposes of getting rid of carbonaceous impurities and of volatile hydrocarbons, which cause the disagreeable odour, are largely employed in refineries; but there is no doubt that distillation at a fixed low temperature would permit expensive chemical operations to be dispensed with to a large extent.

The following statement of the original cost, cost of transporting and refining the crude oil, to one of our most successful Canadian establishments, is stated to be as follows:

Cost of oil at Wyoming Station, per gallon,	0.14 cts.
Cost of transport to Hamilton	0.04 "
Wear of casks..	0.03 "
Refining...	0.07 "
Interest on capital, contingencies, &c, &c.	0.05 "
	0.33 cts.
Selling price	0.70 "
Profit, per gallon	0.37 "

On another page of this number of the Journal, a new process for refining coal and rock oils, recently patented in England, will be found. It is probable that the high price of the chemicals in Canada would for the present preclude its adoption on a large scalê in our refineries.

Extensive refining works are being put up at Petrolia, by the Boston Oil Company, who own some of the most productive wells in that locality. When these come into operation, a considerable additional impetus will be given to the search for the raw material. Besides the refinery already in very successful operation in Hamilton, it is intended to introduce this branch of industry into Toronto, and as there can be little doubt respecting a rapid increase in the supply of the raw material, now that the Corniferous Limestone is known to yield it, the importance of the manufacture of a cheap and excellent illuminator will be felt and appreciated by the public.

Accessibility of the Springs—Wyoming.

The Wyoming Station on the Sarnia branch of the Great Western Railway is about forty-three miles from London and sixteen from Sarnia. On the right or Enniskillen side of the line the country is still nearly in a state of nature, no clearing being visible in the immediate neighbourhood. On the west side there is a considerable tract converted into excellent farms, but the new Village of Wyoming, standing on the edge of the clearings, is still in a rough and primitive condition. The mud road which, passing from the Township of Plympton, penetrates through Enniskillen, is in a shocking state, and may be

described as similar to all mud roads traversing a low and wet country much cut up by traffic. The Village of Wyoming contains two 'hotels,' a few stores, and several buildings in process of erection, among which is a foundry built on or near the site of a grist mill, which was unfortunately destroyed by fire some short time since.

A plank road, passing through the centre of Enniskillen, is about to be constructed, and a bill to incorporate the Petrolem Springs Road Company has already become law. The directors of the Great Western Railway have provided a number of cars for the exclusive transportation of the oil; the lasting odour imparted by this fluid to anything with which it may be brought in contact, has already made 'oil cars' a necessary addition to the rolling stock of the Company.

Quantity of Oil produced in Enniskillen.

The most exaggerated statements have been made respecting the yield of the wells in Enniskillen, and the quantity already exported from Wyoming—the only outlet. By the courtesy of Thos. Bell, Esq., the traffic Superintendent of the Great Western Railway, we are enabled to state that not more than one hundred and seventy thousand (170,000) gallons of Enniskillen oil have been transmitted over the Great Western Railway, from the commencement of the pumping operations to the 30th April, 1861. Of that quantity, Messrs. Williams & Co. alone received, at their Hamilton Works, 125,000 gallons. Assuming that there were 1000 barrels of 42 gallons each at the Wyoming Station, at Petrolia, and Black Creek, waiting transhipment, the total yield of the Enniskillen wells will amount to 212,000 gallons, up to the 30th April, 1861. The value of this, at 14 cents per gallon, amounts to about $30,000.

Such is the position of this new branch of industry in its infancy. It has received a very severe check from the unhappy disturbances in the United States, but there is good reason for the expectation that it will soon become a very important addition to the natural and applied resources of this country.

ON THE CHEMICAL HISTORY OF A CANDLE.

BY M. FARADAY, D.C.L., F.R.S.

From the Chemical News, Jan. 26th 1861.

LECTURE IV.—PRODUCTS: WATER FROM THE COMBUSTION—NATURE OF WATER—A COMPOUND—HYDROGEN.

I see you are not tired of the candle yet, or I am sure you would not be interested in the subject in the way you are. When our candle was burning we found it produced water exactly like the water we have around us; and by further examination of this water we found in it that curious body, hydrogen—that light substance of which there is some in this jar. We afterwards saw the burning powers of that hydrogen, and that it produced water. And I think I introduced to your notice an apparatus which I very briefly said was an arrangement of chemical force, or power, or energy, so adjusted as to convey its power to us in these wires; and I said I should use that force to pull the water to pieces, to see what else there was in the water besides hydrogen; because, you remember, when we passed the water through the iron tube, we by no means got the weight of water back which we put in the form of steam, though we had a very large quantity of gas evolved. We have now to see what is the other substance present. That you may understand the character and use of this instrument let us make an experiment or two. Let us put together, first of all, some substances, knowing what they are, and then see what that instrument does to them. There is some copper (observe the various changes which it can undergo), and here is some nitric acid, and you will find that this being a strong chemical agent will act very much when I add it to the copper. It is now sending forth a beautiful red vapour: but as we do not want that vapour, Mr. Anderson will hold it near the chimney for a short time, that we may have the use and beauty of the experiment without the annoyance. The copper which I have put into the flask will dissolve: it will change the acid and the water into a blue fluid containing copper and other things, and I purpose then showing you how this voltaic battery deals with it; and in the meantime we will arrange another kind of experiment for you to see what power it has. This is asubstance which is to us like water—that is to say, it contains bodies which we do not know as yet. Now this solution of a salt I will put upon paper and spread about, and apply the power of the battery to it, and observe what will happen. Three or four important things will happen which we shall take advantage of. I place this wetted paper upon a sheet of tinfoil, which is convenient for keeping all clean, and also for the advantageous application of the power; and this solution, you see, is not at all affected by being put upon the paper or tintfoil, nor by anything else I have brought in contact with it yet, and which, therefore, is free to us to use as regards that instrument. But first let us see that our instrument is in order. Here are our wires. Let us see whether it is in the state in which it was last time. We can soon tell. As yet when I bring them together, we have no power, because the conveyers—what we call the electrodes—the passages or ways for the electricity—are stopped; but now Mr. Anderson by that [referring to a sudden flash at the ends of the wires] has given me a telegram to say that it is ready. Before I begin our experimen t will get Mr. Anderson to break contact again at the battery behind me, and we will put a platinum wire across to connect the poles, and then if I find I can ignite a pretty good length of this wire we shall be safe in our experiment. Now you will see the power. [The connection was established, and the intermediate wire became red hot.] There is the power running beautifully through the wire, which I have made thin on purpose to show you that we have those powerful forces; and now, having that power we will proceed with it to the examination of water.

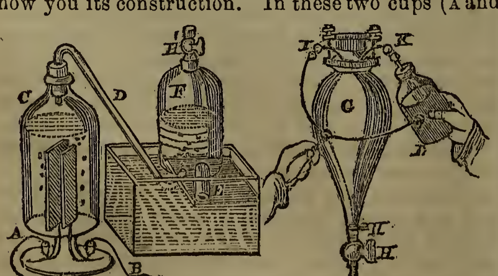
I have here two pieces of platinum, and if I lay them down upon this piece of paper [the moistened paper on the tinfoil] you will see no action; and if I take them up there is no change that you can see, but the arrangement remains just as it was before. But now see what happens: if I take these two poles and put either one or the other of them down sepa-

rately on the platinum plates, they do nothing for me, both are perfectly without action; but if I let them both be in contact at the same moment, see what happens [a brown spot appeared on each pole of the battery]. Look here at the effect that takes place, and see how I have pulled something apart from the white—something brown; and I have no doubt, if I were to arrange this, and were to put one of the poles to the tinfoil on the other side of the paper, why, I get such a beautiful action upon the paper, that I am going to see whether I cannot write with it—a telegram if you please [the Lecturer here traced the word "juvenile" on the paper with one of the terminal wires]. See there how beautifully we can get our results.

You see we have here drawn something, which we have not known about before, out of this solution. Let us now take that flask from Mr. Anderson's hands, and see what we can draw out of that. This, you know, is a liquid which we have just made up from copper and nitric acid, whilst our other experiments were in hand, and though I am making this experiment very hastily, and may bungle a little, yet I prefer to let you see what I do rather than prepare it beforehand.

Now see what happens. These two platinum-plates are the two ends (or I will make them so immediately) of this apparatus; and I am about to put them in contact with that solution, just as we did a moment ago on the paper. It does not matter to us whether the solution be on the paper or whether it be in the jar, so long as we bring the ends of the apparatus to it. If I put the two platinums in by themselves they come out as clean and as white as they go in [inserting them into the fluid without connecting them with the battery]; but when we take the power and lay that on [the platinums were connected with the battery and again dipped into the solution], this, you see, [exhibiting one of the platinums], is at once turned into copper, as it were; it has become like a plate of copper; and that [exhibiting the other piece of platinum] has come out quite clean. If I take this coppered piece and change sides, the copper will leave the right hand side and come over to the left side; what was before the coppered plate comes out clean, and the plate which was clean comes out coated with copper; and you thus see that what copper we put into this solution we can also take out of it by means of this instrument.

Putting that solution aside, let us now see what effect this instrument will have upon water. Here are two little platinum-plates which I intend to make the ends of the battery, and this, (C) is a little vessel so shaped as to enable me to take it to pieces, and show you its construction. In these two cups (A and

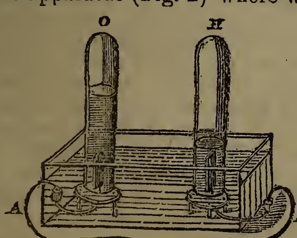


B), I pour mercury, which touches the ends of the wires connected with the platinum-plates. In the vessel (C), I pour some water containing a little acid (but which is put only for the purpose of facilitating the action, it undergoes no change in the process), and connected with the top of the vessel is a bent glass tube (D), which may remind you of the pipe which was connected with the gun barrel in our furnace experiment, and which now passes under the jar (F). I have now adjusted this apparatus, and we will proceed to effect the water in some way or other. In the other case, I sent the water through a tube which was made red hot; I am now going to pass the electricity through the inside of this vessel. Perhaps I may boil the water; if I do boil the water I shall get steam; and you know that steam condenses when it gets cold, and you will therefore see by that, whether I do boil the water or not. Perhaps, however, I shall not boil the water, but produce some other effect. You shall have the experiment and see. There is one wire which I will put to this side (A), and here is the other wire which I will put to the other side (B), and you will soon see whether any disturbance takes place. Here it is seeming to boil up famously; but does it boil? Let us see whether that which goes out is steam or not. I think you will soon see the jar (F), will be filled with vapour, if that which rises from the water is steam. But can it be steam? Why, certainly not; because there it remains, unchanged. There it is standing over the water, and it therefore cannot be steam, but must be a permanent gas of some sort. What is it? Is it hydrogen? Is it steam? Is it anything else? Well, we will examine it. If it is hydrogen it will burn. [The Lecturer then ignited the gas collected, which burnt with an explosion.] It is certainly something combustible, but not combustible in the way that hydrogen is. Hydrogen would not have given you that noise, but the colour of that light when the thing did burn was like that of hydrogen; it will, however, burn without contact with the air. That is why I have chosen this other form of apparatus, for the purpose of pointing out to you what are the particular circumstances of this experiment. In place of an open vessel, I have taken one that is closed; (our battery is so beautifully strong, that we are even boiling the mercury, and getting all things right,—not wrong, but vigorously right); and I am going to show you that that gas, whatever it may be, can burn without air; and in that respect differs from a candle, which cannot burn without the air. And our manner of doing that is as follows:—I have here a glass vessel (C) which is fitted with two platinum wires (J K), through which I can apply electricity; and we can put the vessel on the air-pump and exhaust the air, and when we have taken the air out we can bring it here and fasten it on to this jar (F), and let that gas into the vessel which was formed by the action of the voltaic battery upon the water, and which we have produced by changing the water into it,—for I may go as far as this, and say we have merely, by that experiment, changed the water into that gas. We have not only altered its condition, but we have changed it really and truly into that gaseous substance; and all the water is there which was decomposed by the experiment. As I screw this vessel (G H), on here (R), and make the tubes well connected, and when I open the stop-cocks (H H H), if you watch the level of the water (in F), you will see that that gas will rise. Now, I will close the stop-cocks, as I have drawn up as much as that vessel can hold, and being safely

conveyed into that chamber, I will pass into it an electric spark from this Leyden jar (L), and the vessel, which is not quite clear and bright, will become dim. There will be no sound, for the vessel is strong enough to confine the explosion. [A spark was then placed through the jar, when the explosion mixture was ignited.] Did you see that brilliant light? If I again screw the vessel on to the jar, and open these stop-cocks, you will see that the gas will rise a second time. [The stop-cocks were then opened.] Those gases [referring to the gases first collected in the jar, and which has just been ignited by the electric spark] have disappeared, and as you see: their place is vacant, and fresh gas has gone in. Water has been formed of them; and if we repeat our operation [repeating the last experiment], I shall have another vacancy, as you will see by the water rising. I always have an empty vessel after the explosion, because the vapour or gas into which that water has been resolved by the battery, explodes under the influence of the spark, and changes into water; and by-and-by you will see in this upper vessel some drops of water trickliug down the sides and collecting at the bottom.

We are dealing with water entirely, without reference to the atmosphere. The water of the candle had the atmosphere helping to produce it; but in this way it can be produced independently of the air. Water, therefore, ought to contain that other substance which the candle takes from the air, and which, combining with the hydrogen, produces water.

Now, you saw that one end of this battery took hold of the copper, extracting it from the vessel which contained the blue solution. It was effected by this wire; and surely we may say if the battery has such power with a metallic solution which we made and unmade, may we not think that it is possible that it can split asunder the component parts of the water, and put them into this place and that place? Suppose I take the poles—the metallic ends of this battery—and see what will happen with the water in this apparatus (Fig. 2) where we have sep-



arated the two ends far apart. I place one here (at A), and the other there (at B), and I have little shelves with holes which I can put upon each pole, and so arrange them that whatever escapes from the two ends of the battery will appear as separate gases; for you saw that the water did not become vaporous, but gaseous. The wires are now in perfect and proper connection with the vessel containing the water, and you see the bubbles rising; let us collect these bubbles and see what they are. Here is a glass cylinder (O), I fill it with water and put it over one end (A) of the pile, and I will take another (H) and put it over the other end (B) of the pile. And so now we have a double apparatus, with both places delivering gas. Both these jars will fill with gas. There they go, that to the right (H) filling very rapidly; the one to the left (O) filling not so rapidly; and though I have allowed some bubbles to escape, yet still the action is going on pretty regularly, and were it not that one is rather smaller than the other, you would see that I should have twice as much in this (H), as I have in that (O). Both these gases are colourless; they stand over the water without condensing; they are alike in all things—I mean in all *apparent* things; and we have here an opportunity of examining these bodies and ascertaining what they are. Their bulk is large, and we can easily apply experiments to them. I will take this jar (H) first, and will ask you to be prepared to recognize hydrogen.

Think of all its qualities—the light gas which stood well in inverted vessels, burning with a pale flame at the mouth of the jar, and see whether this gas does not satisfy all these conditions. If it be hydrogen it will remain here while I hold this jar inverted. [A light was then applied and the hydrogen burned.] What is there now in the other jar? You know that the two together make an explosive mixture. But what can this be which we find as the other constituent in water, and which must therefore be that substance which made the hydrogen burn? We know that the water we put into the vessel consisted of the two things together. We find one of these is hydrogen: what must that other be which was in the water before the experiment, and which we now have by itself? I am about to put this lighted splinter of wood into the gas. The gas itself will not burn, but it will make the splinter of wood burn. [The Lecturer ignited the end of the wood and introduced it into the jar of gas.] See how it invigorates the combustion of the wood, and how it makes it burn far better than the air would make it burn, and now you see by itself that every other substance which is contained in the water, and which, when the water was formed by the burning of the candle, must have been taken from the atmosphere. What shall we call it, A, B, or C? Let us call it O—call it "Oxygen;" it is a very good distinct-sounding name. This, then is the oxygen which we present in the water, forming so large a part of it.

We shall now begin to understand more clearly our experiments and researches; because when we have examined these things once or twice we shall soon see why a candle burns in the air. When we have in this way analysed the water—that is to say, separated, or electrolysed its parts out of it, we get two volumes of hydrogen, and one of the body that burns it. And these two are represented to us on this diagram, with their weights also stated, and we shall

1 Hydrogen	8 Oxygen
	9

Oxygen............	88·9
Hydrogen..........	11·1
Water..............	100·0

find that the oxygen is a very heavy body by comparison with the hydrogen. It is the other element in water.

I had better, perhaps, tell you now how we get this oxygen abundantly, having shown you how we can separate it from the water. Oxygen, as you will immediately imagine, exists in the atmosphere, for how should the candle burn to produce water without it? Such a thing would be absolutely impossible, and chemically impossible without oxygen. Can we get it from the air? Well, there are some

very complicated and difficult processes by which we can get it from the air; and we have better processes. There is a substance called the black oxide of manganese; it is a very black-looking mineral, but very useful, and when made red hot it gives out oxygen. Here is an iron bottle which has had some of this substance put into it, and there is a tube fixed to it, and a fire ready made, and Mr. Anderson will put that retort into the fire, for it is made of iron, and can stand the heat. Here is a salt called chlorate of potassa, which is now made in large quantities for bleaching, and chemical and medical uses, and for gunpowder and other purposes. I will take some and mix it with some of the oxide of manganese (oxide of copper, or oxide of iron would do as well), and if I put these together in a retort far less than a red heat is sufficient to evolve this oxygen from the mixture. I am not preparing to make much because we only want sufficient for our experiments but, as you will see immediately, if I use too small a charge the first portion of the gas will be mixed with the air already in the retort, and I should be obliged to sacrifice the first portion of the gas because it would be so much diluted with air; the first portion must, therefore, be thrown away. You will find in this case that a common spirit lamp is quite sufficient for me to get the oxygen, and so we shall have two processes going on for its preparation. See how freely the gas is coming over from that small portion of the mixture. We will examine it and see what are its properties. Now, in this way we are producing, as you will observe, a gas just like the one we had in the experiment with the battery, transparent, undissolved by water, and presenting the ordinary visible properties of the atmosphere. (As this first jar contains the air, together with the first portions of the oxygen set free during the preparation, we will carry it out of the way, and be prepared to make our experiments in a regular, dignified manner.) And inasmuch as that power of making wood, wax, or other things burn, was so marked in the oxygen we obtained by means of the voltaic battery from water, we may expect to find the same property here. We will try it. You see there is the combustion of a lighted taper in air, and here is its combustion in this gas [lowering the taper into the jar]. See how brightly and how beautifully it burns;—you can also see more than this,—you will perceive it is a heavy gas, whilst the hydrogen would go up like a balloon, or even faster than a balloon, when not encumbered with the weight of the envelope. You may easily see that although we obtained from water twice as much in volume of the hydrogen as of oxygen, it does not follow that we have twice as much in weight; because the one is heavy and the other a very light gas. We have means of weighing gases or air; but without stopping to explain that, let me just tell you what their respective weights are. The weight of a pint of hydrogen is three-quarters of a grain; the weight of the same quantity of oxygen is nearly twelve grains. This is a very great difference. The weight of a cubic foot of hydrogen is one-twelfth of an ounce; and the weight of a cubic foot of oxygen is one ounce and a third. And so on we might come to masses of matter which may be weighed in the balance, and which we can take account as to hundred-weights and as to tons, as you will see almost immediately.

Now as regards this very property of oxygen supporting combustion, which we may compare to air, I will take a piece of candle to show it you in a rough way, and the result will be rough. There is our candle burning in the air: how will it burn in oxygen? I have here a jar of this gas, and I am about to put it over the candle for you to compare the action of this gas and that of the air. Why, look at it; it looks something like the light you saw at the poles of the voltaic battery. Think how vigorous that action must be! And yet during all that action nothing more is produced that what is produced by the burning of the candle in air. We have the same production of water; and the same phenomena exactly, when we use this gas instead of air, as we have when the candle is burnt in air.

But now we have got a knowledge of this new substance, we can look at it a little more distinctly, in order to satisfy ourselves that we have got a good general understanding of this part of the product of a candle. It is wonderful, you see, how great the supporting powers of this substance are as regards combustion. For instance, here is a lamp which, simple though it be, is the original, I may say, of a great variety of lamps which are constructed for divers purposes,—for lighthouses, microscopic illuminations, and other uses; and if it was proposed to make it burn very brightly, you would say, "If a candle burnt better in oxygen, will not a lamp do the same?" Why, it will do so. Mr. Anderson will give me a tube coming from our oxygen-reservoir, and I am about to apply it to this flame, which I will previously make burn badly on purpose. There comes the oxygen: what a combustion that makes! But if I shut it off, what becomes of the lamp? [The flow of oxygen was stopped, and the lamp relapsed to its former dimness.] It is wonderful how, by means of oxygen, we get combustion accelerated, But it does not affect merely the combustion of hydrogen, or carbon, or the candle; but it exalts all combustions of the common kind. We will take one which relates to iron for instance, as you have already seen iron burn a little in the atmosphere. Here is a jar of oxygen, and this is a piece of iron wire; but if it were a bar as thick as my wrist, it would burn the same. I first attach a little piece of wood to the iron, I then set the wood on fire, and let them both down together in the jar. The wood is now alight, and there it burns as wood would burn in oxygen; but it will soon communicate its combustion to the iron. The iron is now burning brilliantly, and will continue so for a long time. As long as we supply oxygen, so long can we carry on the combustion of the iron until the latter is consumed.

We will now put that on one side, and take some other substance; but we must limit our experiments for we have not time to spare for all the illustrations you would have a right to, if we had more time. We will take a piece of sulphur: you know how sulphur burns in the air; well, we will put it into the oxygen, and you will see that whatever can burn in air can burn with a far greater intensity in oxygen, leading you to think that perhaps the atmosphere itself owes all its power of combustion to this gas. The sulphur is now burning very quietly in the oxygen; but you cannot for a moment mistake the very high and increased action which takes place when it is so burnt, instead of being burnt merely in common air.

I am now about to show you the combustion of another substance—phosphorous. I can do it better for you here than you can do it at home. This is a

very combustible substance, and if it be so combustible in air, what might you expect it would be in oxygen? I am about to show it to you not in its fullest intensity, for if I did so we should almost blow the apparatus up; I may even now crack the jar, though I do not want to break things carelessly. You see how it burns in the air. But what a glorious light it gives out when I introduce it into oxygen, [Introducing the lighted phosphorous into the jar of oxygen.] There you see the solid particles going off which cause that combustion to be so brilliantly luminous.

Thus far we have tested this power of oxygen and the high combustion it produces, by means of other substances. We must now, for a little while longer look at it as respects the hydrogen. You know when we allowed the oxygen and hydrogen derived from the water to mix and burn together we had a little explosion. You remember also that when I burnt the oxygen and the hydrogen in a jet together, we got a very little light but great heat; I am now about to set fire to oxygen and hydrogen mixed in the proportion in which they occur in water. Here is a vessel containing one volume of oxygen and two volumes of hydrogen. This mixture is exactly of the same nature as the gas we just now obtained from the voltaic battery; it would be far too much to burn at once; I have therefore arranged to blow soap bubbles with it and burn those bubbles, that we may see by a general experiment or two how this oxygen supports the combustion of the hydrogen. First of all we will see whether we can blow a bubble. Well, there goes the gas [causing it to issue through a tobacco-pipe into some soap-suds.] Here I have a bubble. I am receiving them on my hands and you will perhaps think I am acting oddly in this experiment, but it is to show you that we must not always trust noise and sounds, but rather toreal facts. Exploding a bubble on the palm of his hand.] I am afraid to fire a bubble from the end of the pipe because the explosion would pass up into the jar and blow it to pieces. This oxygen then will unite with the hydrogen, as you see by the phenomena and hear by the sound, with the utmost readiness of action, and all its powers are then taken up in its neutralisation of the qualities of the hydrogen.

So now I think you will perceive the whole history of water with reference to oxygen and the air, from what we have before said. Why does a piece of potassium decompose water? Because it finds oxygen in the water. What is set free when I put it in the water, as I am about to do again? It sets free hydrogen, and the hydrogen burns; but the potassium itself combines with oxygen; and this piece of potassium, in taking the water apart,—the water you may say, derived from the combustion of the candle, —takes away the oxygen which the candle took from the air, and so sets the hydrogen free; and even if I take a piece of ice, and put a piece of potassium upon it, the beautiful affinities by which the oxygen and the hydrogen are related are such, that the ice will absolutely set fire to the potassium. I show this to you to-day in order to enlarge your ideas of these things, and that you may see how greatly results are modified by circumstances. There is the potassium on the ice, producing a sort of volcanic action.

It will be my place when next we meet, having pointed out these anomalous actions, to show you that none of these extra and strange effects are met with by us—that none of these strange and injurious actions take place when we are burning, not merely a candle, but gas in our streets, or fuel in our fire-places, so long as we confine ourselves within the laws that Nature has made for our guidance.

TEA, COFFEE, AND COCOA.

Tea and coffee have hardly any other properties in common than the possession of an alkaolid called caffeine or theine, which is identical in the two. Chocolate contains a peculiar alkaloid, theobromine; but the only other substance used extensively for a dietetic infusion, the Paraguay tea, contains theine.

TEA (*Thea Sinensis*).

Tea consists of the leaves of several varieties of a small shrub found in China and India. The leaves are gathered in the fourth year of the growth of the plant, which is generally dug up and renewed in its tenth or twelfth year. The leaves are cropped with care by gatherers, who wear gloves, wash frequently, and avoid eating things likely to affect the breath. The differences between teas result partly from the varieties of soil and growth; but also from the mode of curing and drying the leaves. Black Tea consists of leaves slightly fermented, washed, and twisted. Genuine green tea is made of exactly the same leaves, washed and twisted, without fermentation; but commercial "green" teas are often black teas coloured with Prussian blue. Probably five hundred millions of men, or half the human race, now use tea. In the United Kingdom, above 32 thousand tons, or 73 millions of pounds, are annually used; or about 2⅝ lbs. for every person in the Kingdom. The chief action of tea depends, firstly, on its volatile oil (less in old than in new teas), which is narcotic and intoxicating; and, secondly, on a peculiar crystalline principle, called Theine. Theine excites the brain to increased activity; but soothes the vascular system by preventing rapid change or waste in the fleshy parts of the body, and so economises food. Four grains of Theine, contained in half an ounce of tea, act in this way; but if one ounce of tea, containing 8 grains of Theine, be taken in a day by one person, then tremblings, irritability of temper, and wandering of thoughts, ensue. When the system becomes thus saturated with Theine, it is useful to resort to cocoa as a beverage, for a few days, when the irritable symptoms subside and the use of tea may be renewed.

The tea-leaves, which become changed in the process of drying and preparation, resemble coffee in many points. They are rich in casein or cheese, but contain in the same weight nearly twice as much Theine as coffee. The aromatic oil, which by itself is intoxicating, is present in greater quantity than in coffee. One hundred parts of good tea contain:

Water	5·00			
Theine	3·00			
Casein or Cheese	15·00			
Aromatic Oil	0.75		Water	5 0
Gum	18·00	or	Flesh-formers	18·0
Sugar	3·00		Heat-givers	72.0
Fat	4·00		Mineral Matter	5·0
Tannic Acid	26·25			
Fibre	20·00			
Mineral Matter	5·00			

In an ordinary infusion of tea, the flesh-formers remain with the leaves; but may be taken up by Soda in the water. Hence the practice of the poor of adding Soda to the water in making tea extracts much of its nutritive ingredients. The ingredients in 1 lb. of good tea are:

1. Water in 1 lb. of tea—350 gr.
2. Theine in 1 lb. of tea—210 gr.
3. Casein in 1 lb. of tea—2 oz. 175 gr.
4. Aromatic oil in 1 lb. of tea—52 gr.
5. Gum in 1 lb. of tea—2 oz. 385 gr.
6. Sugar in 1 lb. of tea—211 gr.
7. Fat in 1 lb. of tea—280 gr.
8. Tannic acid in 1 lb. of tea—4 oz. 87 gr.
9. Woody fibre in 1 lb. of tea—3 oz. 87 gr.
10. Mineral matter—350 gr.

Paraguay Tea, or Maté (*Ilex Paraguayensis*). Nat. Ord. Aquifolaceæ.

The Maté occupies the same important position in the domestic economy of South America as the Chinese Tea (*Thea Sinensis*) does in this country. The leaves of the Maté Plant, a species of Holly (*Ilex Paraguayensis*), are from four to five inches in length, and are prepared by drying and roasting, not in the manner of the Chinese Teas, in which each leaf is gathered separately, but large branches are cut off the plants and placed on hurdles over a wood fire until sufficiently roasted; the branches are then placed on a hard floor and beaten with sticks; the dried leaves are thus knocked off and reduced to a powder, which is collected, made into packages, and is ready for use. There are three sorts known in the South American markets: the Caa-Cuys, which is the head of the leaf; the Caa-Miri, the leaf torn from its midrib and veins, without roasting; and the Caa-Guaza or Yerva de Palos of the Spaniards, the whole leaf, with the petioles and small branches roasted. The method of preparing it for drinking is by putting a small quantity, about a teaspoonful, into a gourd or cup, with a little sugar; the drinking tube is then inserted, and boiling water poured on the Maté; when sufficiently cool to drink without scalding the mouth, the infusion is sucked up through the tube. It has an agreeable slightly-aromatic odour, is rather bitter to the taste, and very refreshing and restorative to the human frame after enduring great fatigue. It contains the same active principle as tea and coffee, called Theine; but does not possess the volatile and empyreumatic oils of those substances. It is calculated that about 40,000,000 lbs. of this substance are consumed annually in South America.

The leaves of many plants have been used as substitutes for tea, but they do not seem to contain the same alkaloid. These substances are as follows:

Swiss Tea, prepared from Alpine plants. Fabam Tea of the Mauritius (*Angrœcum fragrans*). Lime flowers and leaves (*Tilia Europœa*). Appallachian Tea (*Prinos glaber*). New Jersey Tea (*Ceanothus Americanus*). Labrador Tea (*Ledum palustre.*)

Coffee (*Coffee Arabica*).

The Coffee plant belongs to the natural order *Chinchonaceœ*, which contain the plants yielding Quinine. It is an evergreen shrub, with oval, shining, wavy, sharp-pointed leaves, white fragrant flowers with projecting anthers, and oblong pulpy berries which are at first green, then of a bright red, and afterwards purple. Each berry contains two seeds, which are covered over with a tough membrane called "parchment." The seeds alone are used in the preparation of Coffee. The Coffee plant is indigenous in Southern Abyssinia, where it grows wild over the rocky surface of the country. In the fifteenth century it was introduced into Arabia; in the sixteenth century, into Constantinople; and in 1652, the first coffee shop was established in London. It is now cultivated in Ceylon, the East and West Indies, and in South America.

The Coffee plant attains a height of from ten to fifteen, or twenty feet. It is planted in nurseries, and at the end of three years bears fruits and seeds, and continues to do so for twenty years. The seeds vary in size according to the countries in which they are produced. The best seeds are obtained from Yemen, the southernmost province of Arabia; these yield the richest Mocha Coffee.

The separation of the seeds from the pulp and parchment of the fruit is a complicated process. The berries are first fermented, the pulp cleared away and the seed dried in the parchment; the latter is afterwards bruised and separated from the seed, which is immediately placed in bags to render permanent the greenish colour that the unroasted Coffee bean possesses. In its unroasted condition the bean consists of a horny mass, which, after it is submitted to roasting, yields very different products from those which existed before that process. Exposure to heat develops the peculiar volatile oils, and the astringent acid, on which the flavour of coffee depends. The oil acts as a stimulant upon the nervous and vascular system, producing an agreeable excitement of the mind, and a gentle perspiration on the skin. It also tends to impede the waste of the tissues of the body, and when taken in too large quantities produces sleeplessness and palpitation of the heart. The acid called Caffeo-tannic, found in roasted coffee, acts as a light astringent; but in this respect coffee does not act so powerfully as tea. It contains a similar active principle to that of tea, called *Caffeine.* The quantity of coffee consumed in the United Kingdom in 1858 was upwards of 35,000,000 lbs. The yearly consumption of coffee in the world is calculated to be about 600,000,000 of pounds.

The chemical properties of the Coffee-berry are altered by roasting, and it loses about 20 per cent. of weight, but increases in bulk one-third or one-half. Its peculiar aroma, and some of its other properties, are due to a small quantity of an essential oil, only one five-thousandth part of its weight, which would be worth about £100 an ounce in a separate state. Coffee is less rich in Theine than tea, but contains more sugar, and a good deal of cheese (Casein). One hundred parts consist of:

Water	12·000			
Caffeine, or Theine	1·750			
Casein, or Cheese	13.000			
Aromatic Oil	0·002			
Sugar	6·500		Water	12·00
Gum	9·000	or	Flesh-formers	14·75
Fat	12.000		Heat-givers	66·25
Potash with a peculiar acid	4·000		Mineral Matter	7·00
Woody Fibre	35.048			
Mineral Matter	6·700			

In the usual way of making coffee, the flesh-formers are thrown away; the addition of a little soda to the water partly prevents this waste. The various ingredients in 1 lb. of coffee are:

1. Water in 1 lb. of coffee—1 oz. 407 grs.
2. Caffeine or Theine in 1 lb. of coffee—122 grs.
3. Casein or Cheese in 1 lb. of coffee—2 oz. 35 grs.
4. Aromatic Oil in 1 lb. of coffee—1½ gr.
5. Gum in 1 lb. of coffee—1 oz. 192 grs.
6. Sugar in 1 lb. of coffee—1 oz. 17 grs.
7. Fat in 1 lb. of coffee—1 oz. 402 grs.

8. Potash, with a peculiar acid, in 1 lb. of coffee—280 grs.
9. Woody fibre in 1 lb. of coffee—5 oz. 262 grs.
10. Mineral matter in 1 lb. of coffee—1 oz. 31 grs.

Coffee Substitutes.

A large number of substances have been employed from time to time as substitutes for coffee, and prepared in the same way. They have none of them established themselves in public reputation, and are seldom sold. This is probably owing to the fact that they do not contain the principal Theine, or any compound analogous to it.

The following substances are used as Coffee Substitutes:

Iris Seeds, and Coffee.
Broom Seed, and Coffee.
Fenugrec Seed, and "Rosetta Coffee."
Spanish Acorns, and Coffee.
Chick Peas, and Coffee.
Swedish Coffee.
Rice, and Coffee.
Carrot Root, and Coffee.
Parsnip Root, and Coffee.
Acorns, and "Hayet's" Coffee.
Beans, and Coffee.
Lupin Seed, and Coffee.
Chicory Root, and Coffee.
Dandelion Root, and Coffee.
Beet Root, and Coffee.

Cocoa (*Theobroma Cacao*). Nat. Ord. Byttneriaceæ.

Cocoa is the seed of the Chocolate Plant, a small tree with dark-green leaves, growing in Mexico, Carraccas, Demerara, and other places. It produces an elongated fruit in shape between a Cucumber and a Melon, which grows directly from the stem or main branches. The seeds or beans that afford the Cocoa are imbedded in the fruit in rows in a spongy substance, and are about fifty or sixty in number. When the fruit is ripe the seeds are taken out, cleaned, and dried, and sometimes a little fermented. The best cocoa is made from these seeds, which are shelled from the outer husks and then roasted. In the inferior kinds the shell is ground up with the seeds. *Cocoa-Nibs* are seeds merely roasted and crushed after being shelled. *Cocoa Paste* is the seed ground down, and when this paste is mixed with sugar, and flavoured with aromatics, as Vanilla, it is called Chocolate. The peculiar flavour of Chocolate is due more especially to Vanilla. The latter substance is the fruit of the *Vanilla aromatica and V. planifolia*, an orchidaceous plant, a native of Mexico, and contains a volatile oil which gives the flavour to Chocolate. Soluble, Rock, Flake, and other Cocoas are the whole seeds ground and mixed with Sugar, Gum, Starch, etc. Cocoa is a rich and nutritious food, containing in 100 parts, 51 of Butter, 22 of starch and Gum, 20 of Gluten or flesh-forming matter, and about 2 parts of a principle called *Theobromine*, to which no doubt its peculiar character is due: Theobromine contains more Nitrogen than Theine, the active principle of Tea and Coffee. The quantity of Cocoa consumed in the United Kingdom in 1858 was 3, 071,115 lbs.

Cocoa, though drunk like Tea and Coffee as a beverage, differs from them remarkably in composition. The distinguising feature of its composition consists in the large quantities of fat and albumen which it contains; so that Cocoa not only acts as an alterative through its Theobromine, but as a heat giving and flesh forming food. 100 parts of Cocoa contain:—

Water	5·0	Water	5·0
Albumen	20·0	Flesh-formers	22·0
Theobromine	2·0	Heat-givers	69·0
Butter	50·0	Mineral Matter	4.0
Woody Fibre	4·0		
Gum	6·0		
Starch	7·0		
Red Colouring Matter	2·0		
Mineral Matter	4·0		

The ingredients in a pound of Cocoa paste are:—

1. 1 lb. of Cocoa nibs.
2. 1 lb. of Cocoa paste.
3. Water—350 gr.
4. Albumen and Gluten—3 oz. 85 gr.
5. Theobromine—140 gr.
6. Butter—8 oz.
7. Gum—426 gr.
8. Starch—1 oz. 53 gr.
9. Woody fibre—280 gr.
10. Colouring matter—140 gr.
11. Mineral matter—280 gr.

—*Guide to the Food Collection, S. Kensington Museum.*

ASHES OR MINERAL MATTERS IN VEGETABLE AND ANIMAL FOOD.

Mineral Matter in Food.

The mineral salts contained in plants and animals are indestructible by heat, hence they are called "ashes."

The body of a man weighing 154lbs. contains about 8 lbs. of mineral matter, consisting of Phosphoric Acid, Silica (or Flint), Chlorine combined with Sodium (common salt), Fluorine combined with Calcium (Fluor Spar), Sulphur, Soda, Potash, Lime, Magnesia, and Oxide of Iron. These substances are extracted from food, and distributed by means of the blood to the various parts of the body, where they are taken up, or absorbed, into the system; different portions of the body showing a strong affinity for different mineral substances: thus, Phosphorus is found in the brain, and also in the form of Phosphoric acid in combination with Lime, in the bones; Fluorine in the bones and teeth; Silica or Flint in the teeth, hair, and nails; Sulphur in the hair; Phosphate of Magnesia and Phosphate of Potash in the flesh; and Phosphate of Soda in the blood and the cartilages. In some cases, as in Phosphate of Lime, which forms the ground-work of bones, the use of mineral matter in the body is sufficiently obvious; but, in other cases, its use is less understood, though it is supposed to exert important action on the transformation of the tissues, and the support of respiration. Mineral matter is quite indispensable to health, and disease results from a deficient supply of it. All animals, man included, require salt for the digestive processes and for the proper secretion of bile; in fact, each substance has its peculiar uses, of many of which we are yet to a great extent ignorant.

Minerals in Food.

In the body of a man, weighing 154 lbs., there are about 8 lbs. of mineral matter. Different parts of the body show peculiar affection for particular ingredients to the exclusion of others.

1. *Phosphate of Lime*, or Bone Earth, consists of three proportions of Lime and one of Phosphoric Acid. There is no animal tissue in the body in which it is

not present. In bone it forms from 48 to 59 parts in 100; the bones most exposed to mechanical influences containing the largest quantity. It is always found with flesh-forming substances, whether derived from the vegetable or animal kingdoms; generally in the proportion of 0.5 to 2 per cent. Casein contains 6 per cent.

2. *Carbonate of Lime*, or Chalk, always occurs in the bones, though in much less quantity than bone earth, the proportions being 1 to 4 parts in a newly born child, 1 to 6 parts in an adult, and 1 to 8 parts in the old. It is also found in animal concretions.

3. *Phosphate of Magnesia.*—This substance is present, in only small quantities, in the bones and in animal fluids.

4. *Fluoride of Calcium*, or Fluor Spar, exists in small quanties in animal tissues, but more abundantly in the bones and teeth.

5. *Silica*, or Flint, exists in small quantities in the enamel of the teeth and hair.

6. *Chloride of Sodium*, or Common Salt, forms the greatest part of the soluble mineral ingredients in all animal tissues. In blood, 6 parts in 1,000 consist of salt. It no doubt exerts an influence on the change of tissues, on the action of the gastric juice, and on other functions.

7. *Carbonate of Soda* is found in small quantities in blood, and is useful in dissolving Fibrin, Casein, and other flesh formers; it may also aid in respiration.

8. *Phosphates of Soda and Potash.* Salts of Soda and Potash certainly exist both in blood and the tissues, and they may be present as phosphates, but our knowledge on this subject is deficient.

9. *Iron* is found in blood, gastric juice, hair, black colouring matter of the eye, etc.

10. *Sulphates of Soda and Potash* exist occasionally in animal fluids, but do not appear to be essential.

11. *Carbonate of Magnesia* occurs very sparingly in the body, and is not deemed essential.

12. *Oxide of Manganese* is found in bile, gall-stones, etc., but would appear to be only accidentally present.

13. *Copper and Lead* are rarely found in the blood but generally in the bile, of man. They are no doubt deleterious, and introduced accidentally.

14. *Sulphocyanide of Sodium*, though not existing in food, is found generally in the saliva of man.

All these substances, as will be seen in the analysis of the human body, are required for forming the blood and the tissues of the human being. As by the use of the body they are constantly being carried away, it is necessary that they should be supplied by means of our daily food. Some plants contain more of one kind of these ingredients than others, thus Liebig has divided plants into four groups, according to the nature of their inorganic constituents.

1. *Lime-Plants*, in which lime abounds, embracing beans, peas, and other *Leguminosæ*.

2. *Alkali-Plants*, which take up potash and soda, as potatoes, beet, &c.

3. *Silex-Plants*, embracing plants which require silica in their tissues, as the palms and grasses.

4. *Phosphorus-Plants*, which contain in their tissues phosphoric acid in the form of phosphates of the earths or alkalies, and embracing the most important food plants, as wheat, barley, oats, rye, &c.

The salts of soda appear to prevail in the blood, but those of potash in the tissues.

The absence of potash in food appears to be the cause of scurvy at sea; and fresh vegetables, or lime juice, which contain potash, are known to be an effectual preventive and cure of this terrible disease.

It should be recollected, that in the boiling of food many of the mineral substances are dissolved out of it, and where the liquid that they are boiled in is not consumed, such mineral matters are thrown away. This is the case with boiled meat and vegetables, and a constant use of such food may lead to injurious effects. The best corrective to such a diet is the use of uncooked fruit and vegetables. In this way the eating of ripe fruits, as apples, pears, gooseberries, &c., and salads, has a beneficial effect on the system.

ON THE PURIFICATION OF BITUMENS AND COAL OILS.

A patent has lately been taken out in England by James Stuart, of London, for the treatment of petroleum and crude oils of all descriptions obtained from coal, shale, bitumen or wells, such as those which have become so numerous in various parts of this country. The following is a condensed description of the invention, taken from the London *Journal of Gas Lighting.* We do not vouch for the *chemistry* of the description. A solution of *chromic acid* in water is a novelty. The practical use of the description is not affected by the mode of describing the effects produced.

"For every 100 gallons of crude oil to be treated, 12½ lbs. of bichromate of potash is taken and dissolved in 12½ gallons of water, and to this solution is added 1¼ gallons of oil of vitriol (the sulphuric acid of commerce). The solution of chromic acid which is thus obtained is added to and mixed with the oil, the oil being kept intimately mixed by churning or agitating it for about an hour. By this treatment, a quantity of pitchy matters and other impurities are separated from the oil, and the oil is deprived of the greater part of its unpleasant smell. The chromic acid is at once converted into oxyd of chromium, with which the excess of sulphuric acid unites, and forms sulphate of chromium. The mixture is now left at rest until separation takes place, which is usually the case in from one to two hours. The oil then being the upper portion is drawn off into another vessel, agitated with a solution of soda for about an hour. This is done to wash out or neutralize any acids remaining in the oil. The solution of soda, which it is preferred to use, is made by dissolving 12½ lbs. of soda ash of commerce in 12½ gallons of water, and adding that quantity to every 100 gallons of oil to be washed. After one hour's agitation, the whole is left at rest until the oil has separated from the soda solution, after which the oil is placed in an iron still, and distilled. The distillation is continued until the whole bulk of oil distilled over reaches .840 sp. gr. at 60° of temperature. The distillate is then to be placed in a proper vessel, and treated as before by churning or agitating with a solution of chromic acid in water. For every 100 gallons of oil to be treated, 12½ lbs. of bichromate of potash is dissolved in 12½ gallons of water, and to the solution is added 1¼ gallons of oil of vitriol. The compound is mixed with the oil by agitation for about an hour, and then the whole is left at rest until the oil is separated from the solution of sulphate of chromium and impurities. Afterward, the oil is drawn off into another vessel, and washed

by mixing or agitating it, for half an hour or thereabouts, with one-fourth its bulk of water or one-fourth its bulk of lime-water. When the water or lime- water has completely separated, and the oil has become bright, it will be fit for use as an illuminating oil. The heavy oil remaining in the still is distilled to dryness, and may then be treated by any of the known methods for obtaining paraffine or lubricating oil. The chromic acid used in the process above described may be obtained otherwise than from the bichromate of potash; it is, however, usually most convenient to employ this salt. It is preferred to apply chromic acid in the first place. to the crude oils, because the solution of chromic acid, by removing the pitch, tar and other impurities from the oil, enables it to be distilled at a heat much lower than would otherwise be necessary, and so prevents decomposition taking place in the still. It is found that, after treating some crude oils with a solution of chromic acid, and distilling until the distillate or whole bulk of oil distilled over reaches 840° sp. gr., that the oil so obtained is of too dark a color to be used as an illuminating oil. In this case, the oil is treated by churning or agitating it with two per cent (by bulk) of oil of vitriol for about an hour, then allowing the whole to rest until the acid, tar or sludge is separated from the oil. The oil is then drawn off into another vessel, and agitated with two per cent of powdered quicklime or dried chalk for another hour, or until all the smell of sulphurous acid has left the oil. There is then added 25 per cent (by bulk) of water, and the whole is agitated for a quarter of an hour; after which time, the mixture is left at rest until the oil has become bright, when it is drawn off for use; but if the oil is not of a good color, it is re-distilled. If there is difficulty in getting the oil perfectly bright, there is added to every 100 gallons of oil, 26 lbs. of common salt dissolved in 8 gallons of water, and the whole is agitated well together for a quarter of an hour; then, when left at rest, the oil will become perfectly bright. In no case however, is the oil of vitriol used for treating the oil, if it can be avoided, as it unites with and decomposes a great part of the lighter oils, and this it is wished to avoid as much as possible. The chromium used in the process may be recovered either as sulphate or oxyd, as desired."

The Board of Arts and Manufactures for Upper Canada.

THE ACT RELATING TO BOARDS OF ARTS AND MANUFACTURES.

The Act relating to the Board of Arts and Manufactures in Upper and Lower Canada has not yet become law. Another year must pass before the desired amendments receive the sanction of Parliament. The unusual shortness of the session and the great press of business were no doubt largely instrumental in preventing the adoption of the amendments desired by the Board, and which they consider necessary to enable them to fulfil the duties imposed by the act of incorporation.

THE INTERNATIONAL EXHIBITION OF 1862.

Our readers will regret to learn that it is not the intention of the Government to appropriate any sum of money, during the present year, towards assisting in the representation of Canada at the International Exhibition of 1862. This determination does not in any way remove or lessen the expectation that a grant will be made early in the ensuing session, for the purposes set forth in the memorials of the Boards for Upper and Lower Canada. It is, however, much to be regretted that no encouragement has been afforded to our Manufacturers and Artizans to prepare the results of their progress during the past ten years for exhibition at London. No doubt great individual exertion will be made and a valuable representation of Canadian industry accumulated; but if the Government had thought proper to lend their material assistance, a very unexpected and encouraging exhibition of the progress of Canadian industry and arts would have been transmitted to London, and Canada would have had no reason to anticipate falling in the rear of her sister Colonies, or of those countries in Europe among whom she occupied an enviable position in 1850 and 1855.

Now that no prospect remains of receiving assistance from Government during the present year, Manufactures and Mechanics will be left to their own energies and resources. These we are sure will never fail; and it may happen that the exhibition of our progress in the industrial arts, resting altogether upon individual effort, will be more satisfactory and encouraging than if supported and cherished by the aid of a pecuniary grant.

PROVINCIAL AGRICULTURAL ASSOCIATION'S EXHIBITION.

The following is the Prize List of the Arts and Manufactures Department of the Agricultural Association's Exhibition, to be held in the City of London, during the last week of September next. The whole of the Rules and Regulations will be published in the next issue.

PRIZE LIST.

ARTS, MANUFACTURES, LADIES WORK, &c., &c.

Diplomas will be awarded in this Department, in addition to first Money Prizes, for Articles or Collections evidencing in their production a high degree of merit. (*See* Rules and Regulations.)

CLASSIFICATION OF PRIZE LIST.

Class.	
40	Architecture, and Miscellaneous Useful and Decorative Arts.
41	Cabinet Ware and other Wood Manufactures.
42	Carriages and Sleighs, and parts thereof.
43	Chemical Manufactures and Preparations.
44	Fine Arts.
45	Furs and Wearing Apparel.
46	Groceries and Provisions.
47	Indian Work.
48	Ladies' Work.
49	Machinery and Models thereof, Castings and Tools.
50	Metal Work, Plain & Ornamental, including Stoves.
51	Miscellaneous.
52	Musical Instruments.
53	Natural History.
54	Paper, Printing, Bookbinding, &c.
55	Pottery, Building and Paving Materials.
56	Saddle, Engine Hose, and Trunk Maker's work, Leather, &c.
57	Shoe and Boot Maker's work, Leather, &c.
58	Woollen, Flax, and Cotton Goods.
59	Foreign Manufactures.

Class 40—Architecture, and Miscellaneous Useful and Decorative Arts,

Sect.		1st Prize.	2nd Prize.
1	Architectural Drawing	6 00	4 00
2	Architectural Drawing, in perspective	6 00	4 00
3	Composition Drawing of Natural Foliage (Canadian) applicable to architectural details.	7 00	5 00
4	Modelling in Plaster of Natural Foliage (Canadian) applicable to architectural details..	7 00	5 00
5	Mathematical, Philosophical and Surveyor's instruments, collection of	10 00	6 00
6	Stained Glass, collection of specimens	6 00	4 00
7	Ventilation of Buildings, Model showing the best system for warming and distributing the air	10 00	6 00
	Miscellaneous.		
8	Banner Painting	6 00	4 00
9	Carving and Gilding	6 00	4 00
10	Carving in Wood	6 00	4 00
11	Carving in Stone	6 00	4 00
12	Drawing of Machinery, in perspective	5 00	3 00
13	Decorative House Painting	5 00	3 00
14	Dentistry, collection of specimens	5 00	3 00
15	Engraving on Wood, with proof	5 00	3 00
16	Engraving on Copper, with proof	5 00	3 00
17	Engraving on Steel, with proof	5 00	3 00
18	Electrotyping, specimens of	5 00	3 00
19	Goldsmith's Work	5 00	3 00
20	Geometrical Drawing of Engine or Millwright work, colored	5 00	3 00
21	Heraldic Painting	5 00	3 00
22	Lithographic Drawing	5 00	3 00
23	Lithographic Drawing, colored	6 00	4 00
24	Lithographic Drawing, on Canadian stone	5 00	3 00
25	Modelling in Plaster	6 00	4 00
26	Monumental Tomb or Head Stone (price and design considered)	6 00	4 00
27	Painting, Imitation of Woods and Marbles	5 00	3 00
28	Picture Frame, ornamented gilt	5 00	3 00
29	Picture Frame, plain gilt	4 00	2 00
30	Seal Engraving, with wax impressions	6 00	4 00
31	Silversmith's Work	5 00	3 00
32	Extra entries		

Class 41—Cabinet Ware, and other Wood Manufactures.

Sect.		1st Prize.	2nd Prize.
1	Bed Room Furniture, set of	8 00	6 00
2	Centre Table	6 00	4 00
3	Drawing Room Sofa	7 00	5 00
4	Drawing Room Chairs, set of	7 00	5 00
5	Dining Room Furniture, set of	8 00	6 00
6	Ottoman	3 00	2 00
7	Side Board	6 00	4 00
8	School Desk and Chairs (price considered)	3 00	2 00
9	Wardrobe	4 00	3 00
	Miscellaneous.		
10	Corn Brooms, six	2 00	1 00
11	Cooper's Work	3 00	2 00
12	Curled Hair, 10 lbs	3 00	2 00
13	Door, 4 or 6 panelled	3 00	2 00
14	Flour Barrels, three	3 00	2 00
15	Handles for Tools, for carpenters, blacksmiths, gunsmiths, watchmakers, &c., &c., collection of	8 00	5 00
16	Joiner's Work, specimen of	4 00	3 00
17	Machine wrought Moulding, 100 feet	3 00	2 00

Class 41—Continued.

Miscellaneous.

Sect.		1st Prize.	2nd Prize.
18	Machine wrought Flooring, 100 feet	3 00	2 00
19	Shingles, Two Bundles of Split	3 00	2 00
20	Turning in wood, collection of specimens	5 00	3 00
21	Veneers from Canadian Woods	5 00	3 00
22	Wash-tubs and Wooden Pails, three of each	3 00	2 00
23	Window Sash hung in Frame, 12 lights	4 00	3 00
24	Wash-boards, six, zinc covered	2 00	1 00
25	Willow Ware, six specimens	3 00	2 00
26	Extra entries		

Class 42—Carriages and Sleighs, and Parts thereof.

Sect.		1st Prize.	2nd Prize.
1	Axle, wrought iron	3 00	2 00
2	Bent Shafts, half dozen	3 00	2 00
3	Buggy, double seated	6 00	4 00
4	Buggy, single seated	5 00	3 00
5	Carriage, two horse, pleasure	10 00	6 00
6	Carriage, one horse, pleasure	7 00	5 00
7	Child's Carriage, (price considered)	3 00	2 00
8	Dog Cart, single horse	5 00	3 00
9	Hubs, two pairs of carriages	3 00	2 00
10	Rims or Felloes, two pairs of carriages	3 00	2 00
11	Spokes, one dozen machine made carriage	3 00	2 00
12	Sleigh, two horse, pleasure	7 00	5 00
13	Sleigh, one horse, pleasure	6 00	4 00
14	Springs, one set of steel carriage	3 00	2 00
15	Wheels, one pair of carriage (unpainted)	4 00	3 00
16	Extras		

Class 43—Chemical Manufactures and Preparations.

Sect.		1st Prize.	2nd Prize.
1	Blacking for shoes	2 00	1 00
2	Essential Oils, assortment of	6 00	4 00
3	Glue, 14 lbs	3 00	2 00
4	Isinglass, 1 lb	3 00	2 00
5	Medicinal Herbs, Roots and Plants, native growth	7 00	5 00
6	Oils extracted from plants	3 00	2 00
7	Oils, Linseed and Rape	3 00	2 00
8	Oil, Coal, Shale or Rock	4 00	3 00
9	Varnishes, assortment of	4 00	3 00
10	Extra entries		

Class 44—Fine Arts.

Professional List — Oil.

Sect.		1st Prize.	2nd Prize.
1	Animals, grouped or single	10 00	6 00
2	Historical Painting, Canadian subject	10 00	6 00
3	Landscape, Canadian subject	10 00	6 00
4	Marine Painting, Canadian subject	10 00	6 00
5	Original Composition, any other subject	10 00	6 00
6	Portrait	8 00	5 00
	In Water Colours.		
7	Animals, grouped or single	7 00	5 00
8	Flowers, grouped or single	7 00	3 00
9	Landscape, Canadian subject	7 00	5 00
10	Marine View, Canadian subject	7 00	5 00
11	Miniature Portrait	6 00	4 00
12	Original Composition, any other subject	7 00	5 00
	Pencil, Crayon, &c.		
13	Crayon, colored	5 00	3 00
14	Crayon, plain	5 00	3 00
15	Pencil drawing	5 00	3 00
16	Pen and Ink Sketch	5 00	3 00
17	Portrait in pencil	5 00	3 00
18	Portrait in crayon	5 00	3 00
	Amateur List—Oil.		
19	Animals, grouped or single	7 00	5 00
20	Historical Painting, Canadian subject	7 00	5 00
21	Landscape, Canadian subject	7 00	5 00
22	Marine Painting, Canadian subject	7 00	5 00
23	Original Composition, any other subject	7 00	5 00
24	Portrait	6 00	4 00

Class 44—Continued.

In Water Colours.

Sect.		1st Prize.	2nd Prize.
25	Animals, grouped or single	6 00	4 00
26	Flowers, grouped or single	4 00	3 00
27	Landscape, Canadian subject	6 00	4 00
28	Marine View, Canadian subject	6 00	4 00
29	Miniature Portrait	4 00	3 00
30	Original Composition, any other subject	6 00	4 00
	Pencil, Crayon, &c.		
31	Crayon, colored	4 00	3 00
32	Crayon, plain	4 00	3 00
33	Pencil Drawing	4 00	3 00
34	Pen and Ink Sketch	4 00	3 00
35	Portrait in pencil	4 00	3 00
36	Portrait in crayon	4 00	3 00
	Photography.		
37	Ambrotypes, collection of	5 00	3 00
38	Photograph Portraits, collection of, colored	7 00	5 00
39	Photograph Portraits, collection of, plain	6 00	4 00
40	Photograph Landscapes and Views, collection of	7 00	5 00
41	Photograph Portraits in oil	6 00	4 00
42	Extras		

Class 45—Furs and Wearing Apparel.

Sect.		1st Prize.	2nd Prize.
1	Business Coat	4 00	3 00
2	Fur Cap	3 00	2 00
3	Fur Gloves, Mits or Gauntlets	3 00	2 00
4	Fur Sleigh Robe	4 00	3 00
5	Gloves and Mits, buckskin	2 00	1 00
6	Gloves and Mits, of any other leather	2 00	1 00
7	Gloves and Mits, lined with wool	2 00	1 00
8	Overcoat	4 00	3 00
9	Pantaloons	3 00	2 00
10	Silk Hat	3 00	2 00
11	Suit of Clothes of Canadian Cloth	5 00	3 00
12	Extra entries		

Class 46—Groceries and Provisions.

Sect.		1st. Prize.	2nd Prize.
1	Barley, Pot and Pearl	3 00	2 00
2	Biscuits, an assortment	4 00	3 00
3	Bottled Fruits, an assortment	3 00	2 00
4	Bottled Pickles, an assortment	3 00	2 00
5	Buckwheat Flour	3 00	2 00
6	Candles, an assortment	3 00	2 00
7	Cayenne Pepper, from Capsicums grown in the Province	2 00	1 00
8	Chickory, 20 lbs of	3 00	2 00
9	Confectionary, an assortment	4 00	3 00
10	Indian Corn Meal	3 00	2 00
11	Mustard, one jar	3 00	2 00
12	Oatmeal	3 00	2 00
13	Preserves, six kinds	3 00	2 00
14	Preserved Meats, one can	3 00	2 00
15	Sauces for table use, an assortment	3 00	2 00
16	Soap, 28 lbs of	3 00	2 90
17	Soaps, collection of assorted fancy	4 00	3 00
18	Starch, 12 lbs of Corn	2 00	1 00
19	Starch, 12 lbs of Flour	2 00	1 00
20	Starch, 12 lbs of Potatoe	2 00	1 00
21	Sugar, 20 lbs of Beet Root	3 00	2 00
22	Sugar, 20 lbs of Corn Stalk	3 00	2 00
23	Sugar, 20 lbs of Maple	3 00	2 00
24	Sugar, one loaf of refined	3 00	2 00
25	Tobacco, 14 lbs of Canadian manufactured	3 00	3 00
26	Varnishes, an assortment	4 00	3 00
27	Wheat Flour	4 00	3 00
28	Extra entries		

Class 47—Indian Work.

Sect.		1st Prize.	2nd Prize.
1	Bark Canoe	4 00	2 00
2	Buckskin Mittens, one pair	2 00	1 00
3	Clothes Basket	2 00	1 00

Class 47—Continued.

Sect.		1st Prize.	2nd Prize.
3	Deer Skin, dressed	2 00	1 00
5	Fruit Basket	2 00	1 00
6	Hand Basket	2 00	1 00
7	Indian Cradle	3 00	2 00
8	Moccasins, one pair of plain	2 00	1 00
9	Moccasins, worked with Porcupine quills, one pair of	3 00	2 00
10	Moccasins, worked with beads, one pair of	3 00	2 00
11	Paddles, two pairs of	3 00	2 00
12	Pipe of Peace	2 00	1 00
13	Rice, 14 lbs of	3 00	2 00
14	Snow Shoes, common size, one pair	3 00	2 00
15	Snow Shoes, eight inches long, one pair	3 00	2 00
16	Sugar, 14 lbs of	3 00	2 00
17	Tobacco Pouch, worked with Porcupine quills	2 00	1 00
18	Extra entries		

Class 48—Ladies Work.

Sect.		1st Prize.	2nd Prize.
1	Bonnet of Canadian straw	4 00	3 00
2	Braiding	4 00	3 00
3	Crochet Work	4 00	3 00
4	Embroidery in Muslin	4 00	3 00
5	Embroidery in Silk	4 00	3 00
6	Embroidery in Worsted	4 00	3 00
7	Gloves, three pairs	3 00	2 00
8	Guipure work	4 00	3 00
9	Hat of Canadian straw	4 00	3 00
10	Knitting	4 00	3 00
11	Lace Work	4 00	3 00
12	Mittens, three pairs of woollen	3 00	2 00
13	Needle work, ornamental	4 00	3 00
14	Netting, fancy	4 00	3 00
15	Quilts in crochet	4 00	3 00
16	Quilts in knitting	4 00	3 00
17	Quilts in silk	4 00	3 00
18	Quilts in piece work	4 00	3 00
19	Shirt, gentleman's	3 00	2 00
20	Socks, three pairs of woollen	3 00	2 00
21	Stockings, three pairs of woollen	3 00	2 00
22	Tatting	4 00	3 00
23	Wax fruit	5 00	3 00
24	Wax flowers	5 00	3 00
25	Worsted work	4 00	3 00
26	Worsted work (raised)	4 00	3 00
27	Extra entries		

Class 49—Machinery and Models thereof, Castings and Tools.

Sect.		1st Prize.	2nd Prize.
1	Castings for General Machinery	6 00	4 00
2	Cast Wheel, spur or bevel, not less than 50 lbs weight	4 00	3 00
3	Castings for Railways, Rail Road Cars and Locomotives, assortment of	10 00	6 00
4	Engine, Steam, of one to four horse power, in operation on the ground	15 00	10 00
5	Engine, Hot Air, one to four horse power, in operation on the ground	15 00	10 00
6	Fire Engine	12 00	8 00
7	Model, in metal of Engine, Millwright's work, or Machinery	7 00	5 00
8	Pump, in metal	4 00	3 00
9	Refrigerator (price considered)	4 00	3 00
10	Scales, platform	4 00	3 00
11	Scales, counter	3 00	2 00
12	Smoke Consuming furnace, in operation on the ground	10 00	6 00
13	Turning Lathe	5 00	3 00
14	Valves and Gearing for working steam expansively, either in model or otherwise, principle of working to be the point of competition	12 00	8 00
	Tools.		
15	Augurs, assortment of	3 00	2 00
16	Augurs, earth	2 00	1 00
17	Axes, six narrow	3 00	2 00
18	Brace Bits, set of	3 00	2 00
19	Bench Planes, set of	3 00	2 00
20	Blacksmith's Bellows	3 00	2 00
21	Cooper's Tools, set of	3 00	2 00
22	Edge Tools, assortment of	12 00	8 00
23	Moulding Planes and Plows, collection of	3 00	2 00
24	Weaver's Reeds, assortment of	2 00	1 00
25	Extra entries		

Class 50—Metal Work, Plain and Ornamental, including Stoves.

Sect.		1st Prize.	2nd Prize.
1	Coal Oil Lamps, an assortment	5 00	3 00
2	Coppersmith's work, an assortment	5 00	3 00
3	Fire Arms, an assortment	5 00	3 00
4	Files, collection of cast steel	3 00	2 C0
5	Finishing in Iron, vice work	3 00	2 00
6	Fire Proof Office Safe	6 00	4 00
7	Gas Fittings, an assortment	6 00	4 00
8	Horse Shoes, set of	2 00	1 00
9	Iron Fencing and Gate, ornamental	6 00	4 00
10	Iron Work from the Hammer, ornamental	5 00	3 00
11	Iron Work, ornamental cast	5 00	3 00
12	Locksmith's Work, an assortment	5 00	3 00
13	Malleable Iron from the ore	5 00	3 00
14	Malleable Iron from scrap iron	5 00	3 00
15	Nails, 20 lbs of pressed	5 00	3 00
16	Nails, 20 lbs of cut	5 00	3 00
17	Ornamental Fencings for Burial Plots in Cemeteries	6 00	4 00
18	Plumber's Work, an assortment	5 00	3 00
19	Screws and Bolts, an assortment	5 00	3 00
20	Sheet Brass Work, an assortment	5 00	3 00
21	Tinsmith's Work, an assortment	5 00	3 00
22	Tinsmith's Lacquered Work, an assortment of	5 00	3 00
23	Wire Work, an assortment	6 00	4 00
	Stoves.		
24	Cooking Stove, for wood, with furniture	5 00	3 00
25	Cooking Stove, for coal, with furniture	5 00	3 00
26	Hall Stove, for wood	4 00	2 00
27	Hall Stove, for coal	4 00	2 00
28	Parlour Stove, for wood	4 00	2 00
29	Parlour Stove, for coal	4 00	2 00
30	Parlour Grate	5 00	3 00
31	Extra entries		

Class 51—Miscellaneous.

Sect.		1st Prize.	2nd Prize.
1	Brushes, an assortment	5 00	3 00
2	Combs, an assortment	3 00	2 00
3	Model of a Steam Vessel	4 00	3 00
4	Model of a Sailing Vessel	4 00	3 00
5	Extra entries		

Class 52—Musical Instruments.

Sect.		1st Prize.	2nd Prize.
1	Harmonium	7 00	5 00
2	Melodeon	6 00	4 00
3	Organ, Church	15 00	8 00
4	Piano, Square	10 00	6 00
5	Piano, Cottage	10 00	6 00
6	Violin	3 00	2 00
7	Extra entries		

Class 53—Natural History.

Sect.		1st Prize.	2nd Prize.
1	Birds—Collection of stuffed Birds of Canada, classified, and common and technical names attached	7 00	5 00
2	Fishes—Collection of Native Fishes, stuffed or preserved in spirits, and common and technical names attached	7 00	5 00
3	Insects—Collection of Native Insects, classified, and common and technical names attached	6 00	4 00
4	Mammalia—Collection of stuffed Mammalia of Canada, classified, and common and technical names attached	7 00	5 00
5	Minerals—Collection of Minerals of Canada, named and classified	7 00	5 00
6	Plants—Collection of Native Plants, arranged in their natural families, and named	7 00	5 00
7	Reptiles—Collection of Reptiles of Canada, stuffed or preserved in spirits, classified, and common and technical names attached	7 00	5 00
8	Stuffed Birds and Animals of any country, collection of	7 00	5 00
9	Woods—Collection of the Woods of Canada, in boards two feet long, one side polished; also, a portion of the tree cut in sections, showing the bark	7 00	5 00

Class 54—Paper, Printing, Bookbinding, and their Materials and Tools.

Sect.		1st Prize.	2nd Prize.
1	Bookbinding, (blank-book)	5 00	3 00
2	Bookbinding, (letterpress)	5 00	3 00
3	Bookbinders, leather, &c., assortment	5 00	3 00
4	Cartridge Paper	2 00	1 00
5	Letterpress Printing, plain	5 00	3 00
6	Letterpress Printing, ornamental	5 00	3 00
7	Paper Hangings, (Canadian paper,) grounded, one dozen rolls	5 00	3 00
8	Paper Hangings, (Canadian paper,) self-grounded, one dozen rolls	3 00	2 00
9	Paper manufactured from straw, an assortment	6 00	4 00
10	Printing Paper, one ream	5 00	3 00
11	Printing Ink	2 00	1 00
12	Printing Type, an assortment	5 00	3 00
13	Wrapping Paper, one ream of stout	3 00	2 00
14	Wrapping Paper, one ream of fine	3 00	2 00
16	Extra entries		

Class 55—Pottery, Building and Paving Materials.

Sect.		1st Prize.	2nd Prize.
1	Bricks for building purposes, one dozen, hollow	5 00	3 00
2	Building and Flagging Stones, Canadian, collection of	10 00	6 00
3	Filterer for water	3 00	2 00
4	Pottery, an assortment	8 00	4 00
5	Sewerage Pipes, stoneware, assortment of sizes	6 00	4 00
6	Stoneware, an assortment	6 00	4 00
7	Slates for roofing	5 00	3 00
8	Extra entries		

Class 56—Saddle, Engine Hose and Trunk Makers' Work, Leather, &c.

Sect.		1st Prize.	2nd Prize.
1	Engine Hose and Joints, $2\frac{3}{4}$ inches diameter, 50 feet of copper rivetted	5 00	3 00
2	Harness, set of double carriage	6 00	4 00
3	Harness, set of single carriage	5 00	3 00
4	Harness, set of team	5 00	3 00
5	Horse Collars, six assorted carriage and team	3 00	2 00
6	Saddle, Ladies' full quilted	6 00	4 00
7	Saddle, Ladies' quilted safe	4 00	3 00
8	Saddle, Gentlemen's full quilted	6 00	4 00
9	Saddle, Gentlemen's plain shaftoe	4 00	3 00
10	Trunk, solid leather	5 00	3 00
11	Trunk, millboard, leather covered	5 00	3 00
12	Trunk, wood, leather covered	3 00	2 00
13	Valises, an assortment	3 00	2 00
14	Whips, an assortment	5 00	3 00
15	Whip Thongs, an assortment	3 00	2 00
16	Hames, four pairs of iron carriage or gig	3 00	2 00
17	Hames, three pairs of iron cased team or cart	3 00	2 00
18	Hames, six pairs of wooden team	3 00	2 00
19	Saddle Tree, Ladies'	3 00	2 00
20	Saddle Tree, Gentlemen's	3 00	2 00
	Leather.		
21	Belt Leather, 30 lbs	3 00	2 00
22	Brown Strap and Bridle, one side of each	3 00	2 00
23	Carriage Cover, two skins	3 00	2 00
24	Deer skins, dressed	2 00	1 00
25	Harness Leather, two sides	3 00	2 00
26	Hog skins, for saddles, three	3 00	2 00
27	Lacing Leather, one hide	2 00	1 00
28	Patent Leather, for carriage or harness work, 20 feet	5 00	3 00
29	Skirting for saddles, two sides	3 00	2 00
30	Extra entries		

Class 57—Shoe and Boot Makers' Work, Leather, &c.

Sect.		1st Prize.	2nd Prize.
1	Balmoral Boots, one pair of Ladies'	3 00	2 00
2	Boot and Shoemakers work, an assortment	6 00	4 00
3	Kid Slippers, one pair of Ladies'	2 00	1 00
4	Lace Boots, one pair of Gentlemen's, sewed	3 00	2 00
5	Lace Boots, one pair of Gentlemen's, pegged	3 00	2 00
6	Wellington Boots, one pair of Gentlemen's, sewed	4 00	3 00
7	Boot and Shoemakers tools, an assortment	6 00	4 00
8	Boot and Shoemakers lasts and trees, an assortment	6 00	4 00
9	Shoe Pegs, an assortment	3 00	2 00

Leather.

Sect.		1st Prize.	2nd Prize.
10	Calf Skins	3 00	2 00
11	Calf Skins, two morocco	3 00	2 00
12	Cordovan, two skins of	3 00	2 00
13	Dog Skins, two dressed	3 C0	2 00
14	Kip Skins, two sides	3 00	2 00
15	Linings, six skins	3 00	2 00
16	Patent Leather for boot makers, twenty feet	5 00	3 00
17	Sheep Skins, six coloured	3 00	2 00
18	Sole Leather, two sides	3 00	2 00
19	Upper Leather, two sides	3 00	2 00
20	Extra entries		

Class 58—Woollen, Flax and Cotton Goods.

Sect.		1st Prize.	2nd Prize.
1	Bags, from Flax the growth of Canada, one dozen	4 00	3 00
2	Bags, one dozen cotton	3 00	2 00
3	Blankets, one pair of woollen	6 00	4 00
4	Carpet, twelve yards of woollen	6 00	4 00
5	Carpet, twelve yards of woollen stair	4 00	3 00
6	Cloth, twelve yards of fulled	6 00	4 00
7	Cloth, twelve yards of broad	6 00	4 00
8	Counterpanes, two	5 00	3 00
9	Cordage, 28 lbs. of flax or hemp	5 00	3 00
10	Cordage and Twines, from Canadian flax or hemp, assortment of	6 00	4 00
11	Check for horse collars, twelve yards	4 00	2 00
12	Drawers, factory made, one pair of woollen	4 00	2 00
13	Flannel, factory made, twelve yards	5 00	3 00
14	Flannel, not factory made, 12 yards	5 00	3 00
15	Horse Blankets, two pairs	5 00	3 00
16	Kersey for horse clothing, twelve yards	5 00	3 00
17	Linen Goods, twelve yards	5 00	3 00
18	Minsey, twelve yards of checked	5 00	3 00
19	Satinet, twelve yards of black	6 00	4 00
20	Satinet, twelve yards of mixed	5 00	3 00
21	Shawls, three woollen	5 00	3 00
22	Shirts, factory made, three woollen	5 00	3 00
23	Stockings, factory made, three pairs of woollen	4 00	2 00
24	Socks, factory made, three pairs of woollen	2 00	1 00
25	Stockings, factory made, three pairs of mixed woollen and cotton	4 00	2 00
26	Socks, factory made, three pairs of mixed woollen and cotton	2 00	1 00
27	Tweed, twelve yards of Winter.	6 00	4 00
28	Tweed, twelve yards of Summer	6 00	4 00
29	Twines, linen and cotton, an assortment	3 00	2 00
30	Woollen Cloths, Tweeds, &c., an assortment	7 00	4 00
31	Woollen Shawls, Stockings, Drawers, Shirts and Mits, an assortment	7 00	4 00
32	Woollen Yarn, white, one pound	2 00	1 00
33	Woollen Yarn, dyed, one pound	2 00	1 00
34	Extra entries		

Class 59—Foreign Manufactures.

Foreign Articles will be admitted for exhibition only; but Certificates will be awarded to any article of worth or peculiar merit.

NOTICES OF BOOKS.

Popular Physical Geology, by J. Beete Jukes, M.A. F.R.S., M.R.I.A. London: Reeve & Co. Toronto: Rollo & Adam.

The illustrations of this excellent little book are admirable. The sketches were made by Mr. G. V. Donoyer, who unites the skill of the artist with the knowledge of the geologist. Mr. Donoyer was the colleague of Mr. Jukes on the Irish Geological Survey. This is not a recent work, it dates from 1853, but the illustrations are widely different from those so frequently met with in works on Popular Geology, that we are induced to recommend it to students as an excellent elementary introduction to the noble science of Geology.

Life in its Lower, Intermediate, and Higher Forms, or Manifestations of the Divine wisdom in the Natural History of Animals.—By Phillip Gosse, F.R.S. New York: Robert Carter & Brother. Toronto: Rollo & Adam.

Mr. Gosse is well known in Canada; his *Canadian Naturalist* is familiar to all our students of nature. The matter of his "Life" is excellent, but the manner in which it has been produced by the American publisher, is not in keeping with the attractive nature of the subject. It has one recommendation—it is cheap, and consequently easily accessible. We give a few paragraphs from the author's introduction:—

"'The works of the Lord are great;' but we must not estimate this greatness by their actual dimensions;

else a man would be of less importance than a hippopotamus, and the Bass Rock would be immensely more valuable than either. It is a greatness not measurable by rule and line; not to be determined by bulk and weight; it is to be estimated by far other qualities,—by the relative importance which the objects bear to each other, by the variety and complexity of their parts, by the elaborateness with which they are constructed, by their fitness for the purposes which they are destined to subserve, and especially by the degree in which they shew forth the power, wisdom, skill, and goodness of Him who made them for His own glory. Many of the animals of which we are about to speak are so minute that the unassisted eye takes no cognizance of their presence; yet most of these,—perhaps all, if we were able to investigate them,—are so curiously fashioned, so elaborately constructed, as to deserve to be included in the category of those works which the adoring Psalmist says are GREAT.

We propose in this volume to describe the various phases of animal life, commencing at the foot of the scale, where we catch the first glimmering of the vital spark, and tracing it step by step upwards through its various developments and changes, its forms and functions. But what is LIFE? There is a mystery couched under that little word which all the researches of philosophers has not been able to solve. Science, with the experience of ages, with all the appliances of art, and with all the persevering ingenuity and skill that could be brought to bear upon it, has ardently laboured to lift the veil; but philosophy, and science, and art, stand abashed before the problem, and confess it a mystery still. The phenomena, the properties of life, are readily observable. We take a bird in our hands; a few moments ago it was full of energy and animation; it shook its little wings as it hopped from perch to perch; its eyes glanced brightly, and its throat quivered as it poured out the thrilling song which delighted us. Now the voice has ceased, the eye is dim, the limbs are stiffening, and we know that it will move no more. Chemical changes have already begun to operate upon its organs; decomposition is doing its work, and soon the beautiful little bird will be a heap of dust. We say that *its life* has gone; but *what* is it that has gone? If we put the body in the most delicate balance, it weighs not a grain less than when it was alive; if we measure it, its dimensions are precisely the same; the scalpel of the anatomist finds all the constituent parts that made the living being; and what that mighty principle is, the loss of which has wrought such a change, alike eludes research and baffles conjecture. We are compelled here to recognize the Great First Cause, and to say, 'In Him we live, and move, and have our being.'"

Selected Articles.

ON SOME POINTS IN AMERICAN GEOLOGY.

BY T. STERRY HUNT, M.A., F.R.S., OF THE GEOLOGICAL SURVEY OF CANADA.

Continued from page 137.

The existence of great dislocations in the Appalachian chain is amply illustrated in the sections of Prof. Rogers, and in those given by Safford in Eastern Tennessee, where by the aid of fossils it becomes comparatively easy to trace them. See the Map accompanying his *Geological Reconnaissance of Tennessee*, 1855; where the magnesian limestones of formation IV, are shown to be not only brought up on the east against the Upper Silurian and Devonian, but even to overlap the black shales at the base of the Carboniferous system. It is remarkable to find that as early as 1822, the idea of a great dislocation of this nature in Eastern New York was maintained by Mr. D. H. Barnes in his description of Canaan Mountain. [*American Journal of Science*, (1) v. pp. 15—18.

To the southeast of this great fault in Canada we have as yet no evidence of Lower Silurian strata higher than those of the Quebec group. At the eastern base of the Green Mts. we find limestones of upper Silurian and Devonian age reposing unconformably upon the altered strata of the Quebec group, themselves also having undergone more or less alteration. Immediately succeeding are the chiastolite and mica slates of Lake St. Francis, which as we have long since stated are probably also of Upper Silurian age.

The White Monntains as we suggested in 1849, (*Am.Jour.Sci.*(2) ix. 19) are probably, in part at least, of Devonian age, and are the representatives of the of the 7,000 feet of Devonian sandstone observed by Sir William Logan in Gaspé. Mr. J. P. Lesley has more recently, after an examination of the White Mts. shown that they possess a synclinal structure, and has adduced many reasons for regarding them as of Devonian age. (*Amer. Mining Journal*, January 1861, p. 99.)

It will be seen from what has been previovsly said that we look upon the 1st and 2nd divisions described by Mr. Safford in Eastern Tennessee, as corresponding to the hypozoic series of Rogers and to the Green Mountain gneissic formation, which instead of being beneath the Silurian series, is really a portion of the Quebec group more or less metamorphosed, so that we recognize nothing in New England or southeastern Canada lower than the Silurian system, nor do we at present see any evidence of older strata, such as Laurentian or Huronian, in any part of the Appalachian chain. The general conclusions which we have previously expressed with regard to the lithological, chemical and mineral relations of the Green Mts. rocks remain unchanged. (*Am. Journal of Science* (2) ix. 12.)

The remarkable parallelism between the rocks of Western Scotland and Canada has already been shown in the existence of the Laurentian, and Cambrian (Huronian) systems, over-laid bv quartzites containing *Scolithus*, to which succeed limestones containing a numerous fauna, identified by Mr. Salter with that of the Chazy limestone. These strata, with an eastward dip, are covered by other quartzites and limestones, to which succeeds the great gneissoid formation of the western Highlands, consisting of feldspathic, chloritic, micaceous, and talcose schists resembling closely the gneissoid rocks of the Green Mts. and including the chromiferous ophiolites of Perthshire, Banff and the Shetland Isles.

This gneissoid series was by Prof. Nichol suggested to be the older or Laurentian gneiss brought up by a dislocation on the east of the Silurian limestones, but Sir Roderick Murchison, with Messrs. Ramsay and Harkness, has shown not only from the differences in lithological character, but from actual sections, that the eastern gneissoid series is made up of altered strata newer than the Silurian limestones.* Thus in geological structure and age, not less than in lithological and mineralogical characters, the rocks of the western Highlands are the counterparts of the Laurentian and Silurian gneiss formations, as seen

* Murchison, Quar. Jour. Geol. Society, Vol. xv. 353 and xvi. 215.

in the Laurentides and Adirondacks, and in the Green Mts. The same parallelism may be extended to Scandinavia, (where Kjerulf and Forbes have shown much of the crystalline gneiss to be of Silurian age,) marking as it would seem the outer edge of a vast Silurian basin, which may be followed in the other direction across the Atlantic to the Gulf of Mexico. We also remark in Great Britain as in America, that whereas the northern outcrop of the palæozoic basin offers at its base only a series of quartzose sandstones reposing upon the Laurentian system and characterized by fucoids and *Scolithus*, we find farther south in England an immense development of shales, sandstones and conglomerates, which form the base of the Silurian system and correspond to the Primoidial zone and the Quebec group.

We have said that upon Lakes Huron and Superior the sandstones of the upper copper-bearing rocks are the equivalents of the Quebec group. The clear exposition of the question by Mr. J. D. Whitney in the *Am. Mining Jour.* for 1860 (p. 435) left little more to be said, but the sections made last year by Mr. Alex. Murray of the Canada Geological Survey place the matter beyond all doubt. On Campment d'Ours, a small island near St. Joseph's, the sandstones of Sault St. Mary are seen reposing horizontally on the upturned edges of the Huronian rocks, and overlaid by limestones which contain in abundance the fossils of the Black River and Birdseye divisions. The only fossil as yet found in these sandstones is a single *Lingula* from near Sault St, Mary, which may be either of Potsdam or Chazy age. The sandstones in question form the upper member of a series of strata which on Lake Superior attain a thickness of several thousand feet, and passing downwards we find a succession of limestones, marls and argillaceous sandstones, interstratified with greenstone and amygdaloid, and followed by about 2000 feet of bluish slates and sandstones, with cherty beds containing grains of anthracite, the whole underlaid by conglomerates, and reposing unconformably upon rocks of the Huronian system. The presence of such slates is the more significant from the occurrence already mentioned of fragments of green and black slates in the coarse grained sandstones near the base of the Potsdam, at Hemmingford mountain, showing the existence of argillaceous shales before the deposition of the quartzites of the Potsdam; these are perhaps more recent than the lowest shales of the Primordial zone, to which however, palæontologically they appear to belong.

This Quebec group is of considerable economic interest inasmuch as it is the great metaliferous formation of North America. To it belongs the gold which is found along the Appalachian chain from Canada to Georgia, together with lead, zinc, copper, silver, cobalt, nickel, chrome and titanium. I have long since called attention to the constant association of the latter metals, particularly chrome and nickel, with the ophiolites and other magnesian rocks of this series, while they are wanting in similar rocks of Laurentian age. (*American Journal of Science* (2) xxvi. 237.)

The immense deposits of copper ore in Eastern Tennessee, and the similar ones in Lower Canada, both of which are for the most parts in beds subordinate to the stratification, belong to this group. The lead, copper, zinc, cobalt, and nickel of Missouri, and the copper of Lake Superior, also occur in rocks of the same age, which appears to have been preeminently the metalliferous period.

The metals of the Quebec group seem to have been originally brought to the surface in watery solution, from which we conceive them to have been separated by the reducing agency of organic matter in the form of sulphurets, or in the native state, and mingled with the contemporaneous sediments, where they occur in beds, in disseminated grains forming *fahlbands*, or as at Acton, are the cementing material of conglomerates. During the subsequent metamorphism of the strata these metallic matters being taken into solution by alkaline carbonates or sulphurets, have been redeposited in fissures in the metalliferous strata, forming veins, or ascending to higher beds, have given rise to metalliferous veins in strata not themselves metalliferous. Such we conceive to be in a few words the theory of metallic deposits; they belong to a period when the primal sediments were yet impregnated with metallic compounds which were soluble in the permeating waters. The metals of the sedimentary rocks are now however for the greater part in the form of insoluble sulphurets, so that we have only traces of them in a few mineral springs, which serve to show the agencies once at work in the sediments and waters of the earth's crust. The present occurrence of these metals in waters which are alkaline from the presence of carbonate of soda, is as we have elsewhere pointed out, of great significance when taken in connection with the metalliferous character of certain dolomities, which as we have shown, probably owe their origin to the action of similar alkaline springs upon basins of sea water.

The intervention of intense heat, sublimation and similar hypotheses to explain the origin of metallic ores, we conceive to be uncalled for. The solvent powers of solutions of alkaline carbonates, chlorids and sulphurets at elevated temperatures, taken in connection with the notions above enunciated, and with De Senarmont's and Daubrée's beautiful experiments on the crystalization of certain mineral species in the moist way, will suffice to form the basis of a satisfactory theory of metallic deposits.*

The sediments of the carboniferous period, like those of earlier formations, exhibit towards the east a great amount of coarse sediments, evidently derived from a wasting continent, and are nearly destitute of calcareous beds. In Nova Scotia Sir Willian Logan found by careful measurement, 14,000 feet of carboniferous strata; and Professor Rogers gives their thickness in Pensylvania as 8000 feet, including at the base 1400 feet of a conglomerate, which disappears before reaching the Mississipi. In Missouri Prof. Swallow finds but 640 feet of carboniferous strata, and in Iowa, their thickness is still less, the sediments composing them being at the same time of finer materials. In fact, as Mr. Hall remarks throughout the whole palæozoic period we observe a greater accumulation and a coarser character of sediments alongst the line of the Apalachian chain, with a gradual thinning westward, and a deposition of finer and farther transported matter in that direction. To the west, as this shore-derived material diminishes in volume, the amount of calcareous matter rapidly augments. Mr. Hall concludes therefore that the coal-measure sediments were driven westward into an ocean, where there already existed a marine fauna. At length, the marine limestones predominating, the coal measures come to be of little importance, and we have a great limestone

* *Quarterly Journal*, Geological Society, vol. xv. 580.

formation of marine origin, which in the Rocky Mountains and New Mexico occupies the horizon of the coal, and itself unaltered, rests on crystaline strata like those of the Appalachian range. In truth, Mr. Hall observes, the carboniferous limestone is one of the most extensive marine formations of the continent, and is characterized over a much greater area by its marine fauna than by its terrestial vegetation.

"The accumulations of the coal period were the last that gave form and contour to the eastern side of our continent, from the Gulf of St. Lawrence to the Gulf of Mexico; and as we have shown that the great sedimentary deposits of successive periods have followed essentially the same course, parallel to the mountain ranges, we naturally inquire: What influence this accumulation has had upon the typography of our country, and whether the present line of mountain elevation from north-east to south-west is in any way connected with the original accumulation of sediments?" (*Hall's Introduction*, p. 66.)

The total thickness of the palæozoic strata along the Appalachian chain is about 40,000 feet, while the same formations in the Mississippi valley, including the carboniferous limestone, which is wanting in the east, have according to Mr. Hall, a thickness of scarcely 4000 feet. * In many places in this valley we find the Silurian formations exposed, exhibiting hills of 1000 feet, made up of horizontal strata, with the Potsdam sandstone for their base, and capped by the Niagara limestone, while the same strata in the Appalachians would give to them sixteen times that thickness. Still, as Mr. Hall remarks, we have there no mountain of corresponding altitude, that is to say, none whose height like those of the Mississippi valley, equals the actual vertical thickness of the strata comprising them. In the west there has been little or no disturbance, and the highest elevations mark essentially the actual thickness of the strata comprising them. In the disturbed regions of the east on the contrary, though we can prove that certain formations of known thickness are included in the mountains, the height of these is never equal to the aggregate amount of the formations. "We thus find that in a country not mountainous, the elevations correspond to the thickness of the strata, while in a mountainous country, where the strata are immensely thicker, the mountain heights bear no comparative proportion to the thickness of the strata." "While the horizontal strata give their whole elevation to the highest parts of the plain, we find the same beds folded and contorted in the mountain region, and giving to the mountain elevations not one-sixth of their actual measurement."

Both in the east and west, the valleys exhibit the lower strata of the palæozoic series, and it is evident that had the eastern region been elevated without folding of the strata, so as to make the base of the series correspond nearly with the sea level, as in the Mississippi valley, the mountains exposed between these valleys, and including the whole palæozoic series, would have a height of 40,000 feet; so that the mountains evidently correspond to depressions of the surface, which have carried down the bottom rocks below the level at which we meet them in the valleys. In other words, the synclinal structure of these mountains depends upon an actual subsidence of the strata along certain lines.

"We have been taught to believe that mountains are produced by upheaval, folding and plication of the strata, and that from some unexplained cause these lines of elevation extend along certain directions, gradually dying out on either side, and subsiding at the extremities. We have, however, here shown that the line of the Appalachian chain is the line of the greatest accumulation of sediments, and that this great mountain barrier is due to original deposition of materials, and not to any subsequent forces breaking up or disturbing the strata of which it is composed."

We have given Mr. Hall's reasonings on this subject, for the most part in his own words, and with some detail, for we conceive that the views which he is here urging are of the highest importance to a correct understanding of the theory of mountains. In the *Canadian Naturalist* for Dec. 1859, p. 425, and in the *American Journal of Science* (2) xxx, 137 will be found an allusion to the rival theories of upheaval and accumulation as applied to volcanic mountains, the discussion between which we conceive to be settled in favour of the latter theory by the reasonings and observations of Constant-Prevost, Scrope and Lyell. A similar view applied to mountain chains like those of the Alps, Pyrennees and Alleghanies, which are made up of aqueous sediments, has been imposed upon the world by the authority of Humboldt, Von Buch and Elie de Beaumont, with scarcely a protest. Buffon, it is true, when he explained the formation of continents by the slow accumulation of detritus beneath the ocean, conceived that the irregular action of the water would give rise to great banks or ridges of sediments, which when raised above the waves must assume the form of mountains; later, in 1832, we find De Montlosier protesting against the elevation hypothesis of Von Buch and maintaining that great the mountain chains of Europe are but the remnants of continental elevations which have been cut away by denudation, and that the foldings and inversions to be met with in the structure of mountains are to be looked upon only as local and accidental.

In 1856 Mr. J. P. Lesley published a little volume entitled *Coal and its Topography*, (12 mo. pp. 224,) in the second part of which he has, in a few brilliant and profound chapters, discussed the principles of topographical science with the pen of a master. Here he tells us that the mountain lies at the base of all topographical geology. Continents are but congeries of mountains, or rather the latter are but fragments of continents, separated by valleys which represent the absence or removal of mountain land [p. 126]; and again "mountains terminate where the rocks thin out," (p. 144.)

The arrangement of the sedimentary strata of which mountains are composed may be either horizontal, synclinal, anticlinal or vertical, but from the greater action of diluvial forces upon anticlinals in disturbed strata it results that great mountain chains are generally synclinal in their structure, being in fact but fragments of the upper portion of the earth's crust, lying in synclinals, and thus preserved from the destruction and translation which have exposed the lower strata in the anticlinal valleys, leaving the intermediate mountains capped with lower strata. The effects of those great and mysterious denuding forces which have so powerfully modified the surface of the

* In Michigan, according to the late report of Prof. Winchell, the total observed thickness of the strata from the top of the Sault St Mary sandstones to the top of the carboniferous series is little over 1700 feet. divided as follows:—Trenton and Hudson River groups, 50 feet, Upper Silurian 185, Devonian 782, Carboniferous 700; of this last the true coal measures constituse 123 feet, including from 3 to 10 feet of workable bituminous and cannel coals, while near the base of the carboniferous series are found 169 feet of gypsiferous marls, which yield strong brine springs.

globe become less apparent as we approach the equatorial regions, and accordingly we find that in the southern portions of the Appalachian chain many of the anticlinal folds have escaped erosion, and appear as hills of an anticlinal structure. The same thing is occasionally met with further north; thus Sutton mountain in Canada, lying between two anticlinal valleys, has an anticlinal centre, with two synclinals on its opposite slopes. Its form appears to result from three anticlinals, the middle one of which has to a great extent escaped denudation.

The error of the prevailing ideas upon the nature of mountain chains may be traced to the notion that a disturbed condition of the rocky strata is not only essential to the structure of a mountain, but an evidence of its having been formed by local upheaval, and the great merit of De Montlosier and Lesley, (the latter altogether independently,) is to have seen that the upheaval has been in all cases not local but continental, and that the disturbance so often seen in the strata is neither dependent upon elevation nor essential to the formation of a mountain. The synclinal structure of portions of the Alps, previously observed by Studer and others, has been beautifully illustrated by Ruskin in the fourth volume of his *Modern Painters*, and in a late review of Alpine geology we have endeavoured to show that the Alps, *as a whole*, have likewise a synclinal structure. (*American Journal of Science*, xxix. 118.)

(*To be concluded in our next.*)

VARNISHES.*

The following Recipes for the preparation of Varnishes will be found useful to a large class of the readers of this Journal. It is proposed, in subsequent numbers, to introduce under the headings Cements, Alloys, Plastering Glues, Papers, Bronzing, Polishes, Bookbinders' Recipes, Gilding, Inks, Waxes, &c., &c., a variety of practical information, which will no doubt be appreciated by Mechanics and others engaged in different branches of industry.

Preparations of Lac.—Stick-lac consists of twigs of several kinds of trees encrusted a resinous matter, produced by the puncture of an insect called the *Cocus lacca.* This, triturated with water, and dried, forms seed-lac. The seed-lac, when heated and pressed in cotton bags, forms shell-lac. Lac dye is the coloring matter extracted from stick-lac by water, and evaporated to dryness, with the addition of earthy matters, and formed into square cakes. Seed-lac and shell-lac are chiefly used in varnishes, dissolved in rectified spirits, or rectified wood naphtha. The alcoholic solution is rendered paler, so that it may be used for polishing ilght colored woods, by digesting it in the sun, or near a fire, for two or three weeks, with good animal charcoal, and then filtering it through paper in a funnel heated with hot water. Shell-lac may be bleached by dissolving it in a solution of potash, or soda, and passing chlorine into the solution. The precipitated lac is collected, and well washed. Kastner directs 3 parts of carbonate of potash to be dissolved in 24 of water, and 3 of lime added, and the whole digested in a close vessel for twenty-four hours. The clear liquor is poured off, and boiled with 4 parts of shell-lac. When cold, dilute with 4 times its bulk of water and filter; then add chloride of lime, and afterwards diluted muriatic acid. With these preliminary remarks we come now to the lacquers, or varnishes.

The Famous Brilliant French Varnish for Boots and shoes.—Take $\frac{3}{4}$ of a pint of spirits of wine; 5 pints white wine; $\frac{1}{2}$ pound of powdered gum senegal; 6 oz. loaf sugar; 2 oz. powdered galls; 4 oz. green copperas. Dissolve the sugar and gum in the wine. When dissolved, strain; then put it on a slow fire, being careful not to let it boil. In this state put in the galls, copperas, and the alcohol, stirring it well for five minutes. Then set off, and when nearly cool strain through flannel, and bottle for use. It is applied with a pencil brush. If not sufficiently black a little sulphate of iron, and half a pint of a strong decoction of logwood, may be added, with $\frac{1}{16}$ oz. pearl ash.

Black Varnish.—Take any varnish, of the class you wish, 16 parts; lamblack 2 parts. Grind the black in a small quantity of the varnish, then mix it with the remainder.

Cabinet-makers' Varnish.—Pale shell-lac 700 parts; mastic 65 parts; strongest alcohol 1000 parts. Dissolve. Dilute with alcohol.

Callott's Soft Etching Varnish.—Linseed oil 8 parts; benzoin 1 part; white wax 1 part. Melt and keep it heated until reduced to two thirds.

Pale Carriage Varnish.—Copal 32 parts; pale oil 80 parts. Fuse and boil until stringy; then add dried white copperas 1 part; litharge 1 part. Boil again, then cool a little, and mix in spirits of turpentine 150 parts. Strain. While making the foregoing, take of gum animé 32 parts; pale oil 80 parts; dried sugar of lead 1 part; litharge 1 part; spirits of turpentine 170 parts. Pursue the same treatment as before and mix the two compositions while hot.

Second quality of Carriage Varnish.—Take of gum animé 32 parts; oil 100 parts; spirits of turpentine 150 parts; litharge 1 part; dried sugar of lead 1 part; dried copperas 1 part. Proceed as above.

Copal Varnish.—Copal 30 parts; drying oil 25 parts; spirits of turpentine 50 parts. Put the copal into a vessel capable of holding 200 parts, and fuse it as quickly as possible, then add the oil, previously heated to nearly the boiling point. Mix well, then cool a little, and add the spirit of turpentine; again mix well, cover up until the temperature has fallen to 140° Fah.; then strain.

To Dissolve Copal in Spirit.—Take the copal and expose it in a vessel formed like a colander to the front of a fire, and receive the drops of melted gum in a basin of cold water; then well dry them in a temperature of about 95° Fah. By treating copal in this way it acquires the property of dissolving in alcohol.

Black Copal Varnish.—Take lamp-black or ivory-black, in fine powder, and mix it with the varnish.

Blue Copal Varnish.—Indigo, Prussian blue, blue verditer, or ultra-marine. These substances must be powdered fine. Proceed as before.

Fine Pale Copal Varnish.—Pale African copal 1 part. Fuse, then add hot pale oil 2 parts. Boil until the mixture is stringy, then cool a little, and add 3 parts of pale spirits of turpentine. Mix well.

* The Mechanic, Machinist, and Engineer's Practical Book of Reference. Edited by C. W. Harkley, Professor of Mathematics in Columbia College, N. Y.

Flaxen Grey Copal Varnish.—Ceruse, which forms the ground of the paste, mixed with a small quantity of Cologne earth, as much English red, or carminated lake, and a particle of Prussian blue, and color the varnish therewith.

Green Copal Varnish.—Verdigris, crystallized verdigris, compound green (a mixture of yellow and blue). The first two require a mixture of white in proper proportions from a fourth to two-thirds according to the tint intended to be given. The white lead used for this purpose is ceruse, or the white oxide of lead, or Spanish white. Proceed as before.

Improved Copal Varnish.—Caoutchoucine (white and scentless), strong alcohol, equal parts; copal in the proportion of two pounds to a gallon. Digest in a close vessel, without heat, for one week.

Pearl Grey Copal Varnish.—White and black; white and blue; for example, ceruse and lamp-black; ceruse and indigo. Mix them with the varnish, according to the tint required.

Purple Copal Varnish.—Prussian blue and vermillion, or any other blue and red; then proceed as before.

Red Copal Varnish.—1. Vermilion, red oxide of lead (minium), red ochre, or Prussian red, &c., and proceed as before.

2. Dragons's blood, brick red, or Venetian red, &c., and prooceed as before.

Violet Copal Varnish.—Vermillion, blue, white, in proportions required to color the varnish.

White Copal Varnish.—Copal 16 parts; melt, and add hot linseed oil 8 parts; spirits of turpentine 15 parts; finest white lead to color.

Yellow Copal Varnish.—Yellow oxide of lead, or Naples and Montpelier, both reduced to impalpable powder. These yellows are hurt by contact with iron or steel. In mixing them, therefore, a horn spatula, with a glass mortar and pestle, must be employed. Or gum guttæ, yellow ochre, or Dutch pink, according to the nature and tone of the color to be imitated, and proceed as before.

Mastic Varnish.—Gum Mastic 5 pounds; spirits of turpentine 2 gallons. Mix with a moderate heat (carefully applied), in a close vessel, then add pale turpentine varnish 3 pints. Mix well.

Another.—Mastic 1 pound; white wax 1 ounce; oil of turpentine 1 gallon. Reduce the wax and mastic small, then digest in a close vessel, with heat, until dissolved.

Common Oil Varnish.—Resin 4 pounds; genuine beeswax ½ pound; boiled oil 1 gallon. Mix with heat, then add spirits of turpentine 2 quarts.

Turpentine Varnish.—Resin 1 part; boiled oil 1 part. Melt, then add turpentine 2 parts. Mix well.

White Hard Spirit Varnish.—Gum sandarach 2½ pounds; alcohol (65 op.) 1 gallon. Place them in a strong, well closed vessel, and apply the heat of warm water, with occasional agitation, until dissolved; then add pale turpentine varnish 1 pint. Mix well, and let the whole rest for twenty-four hours, when it will be ready for use.

White Spirit Varnish.—Strongest alcohol 100 parts; sandarach 25 parts; tears mastic 6 parts; elemi 3 parts; Venice turpentine 3 parts. Dissolve in a closely corked vessel.

Varnish for Toys.—Copal 7 parts; mastic 1 part; Venice turpentine ½ part; strongest alcohol 11 parts. Dissolve the copal first, with the aid of a little camphor, then add the mastic, &c., and thin with alcohol, as required.

To Clean Varnish.—Use a ley of potash, or soda, mixed with a little powdered chalk. Do not make the liquor too strong of the alkali.

Te Polish Varnish.—Take 2 oz. powdered tripoli, put in an earthen pot, with water to cover it; then take a piece of white flannel, lay it over a piece of cork or rubber, and proceed to polish the varnish, always wetting it with the tripoli and water. It will be known when the process is finished by wiping a part of the work with a sponge, and observing whether there is a fair even gloss. When this is the case, take a bit of mutton suet and fine flour, and clean the work.

Varnish for Harness.—Take ½ pound of India-rubber; one gallon of spirit of turpentine; dissolve enough to make into a jelly; then take equal quantities of good hot linseed oil, and the above mixture. Incorporate them well on a slow fire, and it is fit for use.

A Varnish for Fastening the Leather on Top Rollers in Factories.—Dissolve 2¾ oz. of gum arabic in water; and a like amount of isinglass dissolved in brandy, and it is fit for use.

A Varnish to Preserve Glass from the Rays of the Sun.—Reduce a quantity of gum tragacanth to fine powder, and let it dissolve for twenty-four hours in white of eggs well beat up; then rub it gently on the glass with a brush.

A fine Black Varnish for Coaches and Iron Work.—Bitumen of Palestine 2 oz.; resin 2 oz.; umber 12 oz, Melt them separately, and then mix together over a moderate fire. Then pour upon them, while on the fire, 6 oz. clear boiled linseed oil, stirring the whole from time to time. Take it off the fire, and when moderately cool pour in 12 oz. of essence of turpentine.

Varnish for Clock Faces.—Spirits of wine 1 pint; divide it into four parts; mix one part with ½ an oz. of gum mastic in a bottle by itself; one part of spirit and ½ oz. gum sandarach in another bottle; and one part spirit and ½ oz. whitest part of gum benzoin. Mix and temper them to suit; if too thick add spirit; if too thin a little mastic; if too soft some sandarach or benzoin. When about to use it warm the silver plate before the fire, and with a flat camel-hair pencil stroke it over till no white streaks appear; this will preserve it for many years.

MISCELLANEOUS.

Iceland Cod Fisheries

Upwards of one hundred small vessels, employing about 1,200 or 1,500 men, are annually fitted out at Dunkirk for these fisheries, the value of the produce of which is estimated at £120,000 to £160,000. It is principally used for home consumption, and Paris is the chief mart. What is unsold at the approach of a new fishing season, is dried and shipped to the colonies—and also to the Portuguese ports, the French Government accord a premium of from 12 to 20 francs per 100 kilos, the amount varying according to distinction.

The Oreide of Gold.

This substance, of which so many articles called Jewellery are now made, is simply an alloy of copper and zinc—a brass of a peculiar color resembling "jeweler's gold" of about 16 carats fine—copper and gold mixture. It is the invention of MM. Mourier and Vallent—two Frenchmen. It was patented in France in December, 1854, and in the United States in March, 1857. Some of our daily papers have lately referred to this substance as if it were some new discovery; whereas, if they had consulted the pages of the *Scientific American*, they would have found it described in full on page 308, Vol. XII., old series, (June, 1857). It is composed of 100 parts (by weight) of pure copper, 17 of zinc, 6 of common magnesia, 3.60 salammoniac, 1,80 quick lime and 9 of crude tartar. The copper is first melted in a crucible, then the magnesia added, then the salammoniac, lime and tartar separately, and in powder. These are kept from contact with the air, and all well stirred for about 20 minutes, until they are incorporated together. The zinc is now added in strips, which are thrust under the scurf formed on the top of the crucible. The mass is now stirred, the lid put on the crucible and its contents kept fused for about 25 minutes; after which the crucible is opened, the slag skimmed carefully from the surface, then the molten alloy is poured out into ingot molds if it is required to be rolled, or into iron rolls if designed for castings. When designed for works of art, however, it is best to cast it into ingot form first, then melt it in a furnace and cast it. This alloy is very beautiful, an d well deserves the name of "oreide of gold," as it greatly resembles the precious metal. It is very ductile, and may be rolled into very thin leaf; but it is nearly as easily tarnished as common brass.—*Scientific American.*

The Whaling Business.

An article in a recent issue of the Boston *Commercial Bulletin*, contains some very interesting information on this subject. For many years New Bedford, Mass., has been known, not only as the greatest whaling port in the United States, but the whole world; it is now, however, falling fast from its former oily greatness. In 1857 there were 329 vessels of 111,364 tons belonging to New Bedford; but at the present time there are only 291 vessels of 98,760 tons, a decrease of 38 vessels and 12,604 tons. This reduction has not been caused by losses of ships at sea, but by their withdrawal from the trade, as the business has been very unprofitable for the past four years. The price of whale oil has been greatly affected by substitutes, especially coal oil, and the more general adoption of gas in cities and large villages. In 1860, the price of whale oil was only 50 cents per gallon, while in 1857 it was 73 cents, and this reduction of price was accompanied with another blow at whaling, namely, a very limited catch of whales. In 1857, the average catch was 800 barrels; last year it was only 500 barrels.

One-half of the whaling fleet is devoted to the sperm whale fishery, the other half to the right whale fishery. One-half of all the sperm oil obtained goes to England, and amounts to about 75,500 barrels annually, valued $81,500,000. The right whale produces the whalebone, most of which goes to Germany; the annual value of it is $1,000,000 The amount invested in the whaling trade in new Bedford is $10,000,000. Many of the merchants in that place are now looking around to see if they cannot enter upon a more profitable business. The total whaling fleet of the United States now comprises 514 vessels of 158,476 tons. There has been a total decrease of 141 ships in four years. In 1858 two hundred ships went to the North Pacific for whale oil; it is expected that only one hundred will go this year.—*Ibid.*

Water-proof Cloth.

The Paris *Moniteur Industriel* states that 20,000 tunics rendered water-proof and yet porous, were served out to the French army during the late war with Russia. They were prepared in the following manner: Take 2 lbs. 4 oz. of alum, and dissolve it in 10 gallons of water; in like manner dissolve the same quantity of sugar of lead in a similar quantity of water, and mix the two together. They form a precipitate of the sulphate of lead. The clear liquor is now withdrawn, and the cloth immersed for one hour in the solution, when it is taken out, dried in the shade, washed in clean water and dried again. This preparation enables the cloth to repel water like the feathers of a duck's back, and yet allows the prespiration to pass somewhat freely through it, which is not the case with gutta-percha or India-rubber cloth.

Starch from Potatoes.

At Stowe, Vt., there are five factories in which starch is made from potatoes. Each consumes about 20,000 bushels per annum, and eight pounds of starch is the yield of each bushel.—*Scientific Amer.*

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

THE JOURNAL

OF THE

Board of Arts and Manufactures,

FOR UPPER CANADA.

JULY, 1861.

THE INTERNATIONAL EXHIBITION OF 1862.

When the proposition to hold an International Exhibition in London, in 1851, was first put forward, the greatest obstacles to its successful accomplishment were found to consist in the prejudices of the great mass of the British people. The manufacturers and machinists dreaded the exposure of all the best specimens of their skill to the inspection and imitation of foreigners; others loudly condemned the folly of permitting their own countrymen to see and examine the finest productions of other lands, and thus inflicting a grievous injury upon the home trade. Every argument, in fact, that could be suggested by ignorance or jealousy was urged in opposition to this project. But at last the few who gave themselves up to the task, succeeded by their untiring energy and zeal, after appealing to the common sense of the community, in removing such obstacles, and had at length the satisfaction of finding their efforts crowned with preëminent success. At this time, however, such prejudices no longer exist; all agree in acknowledging that so far from an exhibition of this kind proving an injury to the country, it is calculated to confer upon it an almost inestimable benefit. Already has this feeling been substantially manifested; a guarantee deed to the amount of £414,600, has been signed by nearly 1000 persons connected with or interested in Arts, Manufactures, and Commerce, a sum amply sufficient to carry out the enterprise without risk of loss or failure. Such an array of names indicates most clearly the general conviction that great good resulted from the exhibition of 1851, and that a suitable time has again arrived for testing and comparing the progress of all nations in Arts, Manufactures and all other departments of industry. It will be well then to consider briefly the grounds upon which the expectation is founded, that the exhibition to be held in 1862, will prove worthy of the age, and show that such an advance has been made in industrial processes as to warrant the promoters in deciding upon ten years as the proper period for the recurrence of such undertakings. First then let us refer to the progress of the nation since 1851.*

The population of Great Britain has largely increased. In 1851 it was 25,180,555, and in 1862 it will probably be 29,000,000. In London there will be next year half a million more inhabitants than in 1851. The people are better employed, and their social and intellectual condition is improved.

Railways have been extended from above 6000 to above 10,000 miles.

The electric telegraph has become universal, and in every direction facilities for communication have been increased. The duties on soap and paper, the only manufactures the prosperity of which was then thwarted by excise restrictions, have been repealed. All taxes on the dissemination of knowledge have been abolished, and increased facilities have been afforded for the circulation of knowledge by post. The import duties have been repealed, or very nearly so, on raw materials, the produce of foreign countries. The manufactures also of foreign lands have been admitted, free of duty, to compete with those of the country; old industries have been stimulated and improved. New industries have arisen.

In fine arts, painting and sculpture, it is hardly possible, except in very extraordinary periods, that a marked change can be observed in a single ten years; but this country certainly holds it own, as compared with the productions of other countries.

Photography, hardly known in 1851, has developed itself, and has become an important branch of art and industry, used alike by the artist, the engineer, the architect, the manufacturer, the merchant and the magistrate.

In the preparation of colours for printing and dyeing, most important discoveries have been made. The recently discovered and most beautiful and brilliant colours, called the "Aniline" series, are produced from coal and its products, and the facility of their application is so great that a complete revolution is taking place in the processes of dyeing and printing.

In the manufacture of glass great economy has been introduced; and the process, just perfected, of transferring photographs to glass, and permanently fixing them by the action of fire, will add a new and beautiful style of ornamentation to buildings of every description. The manufacture of agricultural implements, and especially the application of steam power to them, has been so improved and extended that it is now a highly important branch of trade; and the exhibition of the improvements which have been made in spinning, weaving, and winding machinery, will afford interesting evidence of the mechanical progress in these branches of industry. In the manufacture of iron, improvements are also made; its production is continually being economized, and a metal between iron and steel is now produced, at one process, which heretofore required two or more processes, alike expensive and difficult.

In artificial light, the sphere of production is en-

* Condensed from an article in a recent number of the *Journal of the Society of Arts*, London.

larged and light is cheaper, whereby hours are now available for industrial pursuits, and for the acquisition of knowledge by large numbers, which were formerly either unemployed or wasted. In steam-power, especially that applied to railroads and to ocean steam navigation, economical appliances have advanced rapidly. In ship building, the past ten years have produced vast changes. The navy and mercantile marine have advanced in scientific construction and in mechanical arrangement. The ocean steamers which were then employed in the postal service included but one of 2,000 tons; now there are many of nearly double that tonnage, with corresponding power and speed. In printing, great advances have been made; in the perfection of chromatic printing, and in the application of most expensive and most beautiful machinery to the printing of the daily journals. Invention and mechanical contrivances have thus kept pace with the requirements of intellect and the daily increasing love of knowledge.

The effect of the progress that has been made since 1851 is also shown by the rapid increase of colonial and foreign trade, and the much greater interest that foreigners take in England and English manufactures.

On such topics one might enlarge at any length, but enough has been said to show that, if the Exhibition of 1851 was "to form a new starting point from which all nations were to direct their further exertions," that of 1862 will surely still more efficiently perform that office, inasmuch as the basis upon which it rests is broader, the nations interested in the progress of civilization and commercial freedom more numerous, and the population to be stimulated to exertion enormously larger.

Since then so much may be expected from the mother country, in addition to what was done in 1851, surely expectations, in at least an equal proportion, may be formed respecting the position which Canada ought to take in the approaching Exhibition. Our country has since that time made enormous strides in everything that tends to its advancement and material progress. Then it had but recently emerged from a period of discontent and difficulty; now it is — as is acknowledged on all hands—the most flourishing and rapidly increasing in wealth and population of all the Colonies of the British Empire. It now has a system of railway and water communication unsurpassed any where; the Victoria Bridge over the St. Lawrence being one of the greatest engineering triumphs in the world.

While it is a matter of extreme regret that the Government do not intend to appropriate any sum of money, during the present year, towards the representation of Canada at the International Exhibition of 1862, still we trust that our manufacturers and artizans will not be discouraged, but will set about the preparation of the products of their skill with the energy that is their great characteristic, and thus render the exhibition of our progress, resting as it must upon individual resources, the more satisfactory and encouraging than if it were mainly dependent upon pecuniary aid bestowed by our Government.

THE DUNDAS COTTON MANUFACTORY.

The subjoined notice of the Dundas Cotton Works is taken from a late number of the "*True Banner*," published in that town. We rejoice to find that such an establishment has been set in active operation, and we heartily concur in the wishes of our contemporary for the success of the undertaking.

About a year ago, Joseph Wright, Esq., a gentleman whose experience in the Cotton Manufacturing business in England extends over a lengthy period of years, purchased the large brick and stone building erected in this town by Holt & Co., for the purpose of converting the same into a Cotton Factory, since which time he has been actively engaged fitting up machinery for the prosecution of the enterprize; and we are happy to be able to announce that he has now got his works so far advanced as to be able to turn out a very large quantity of cotton-batting and yarn daily. We visited the establishment on Friday last, when we were very courteously shown through the various departments thereof, and had an opportunity of watching the process of manufacture from the raw cotton to the packing of the batting and yarn in bales ready for the market; and as it may prove interesting to some of our readers to know something of the operations that are necessary for the conversion of the raw material into such marketable products as are daily sold and bought in large quantities in every section of the country, we give a brief outline thereof. In the manufacture of Batting, the raw cotton is first thrown into a machine called a "whipper," where it is beaten out and cleaned; it is then passed to a machine called a "scutcher," where all the seeds and dust that may still be in the cotton are removed, and where it is brought out into what is called a "lap," when it is ready for the carding machines, through which it passes and receives the final dressing, and is wound on large drums and cut into six feet lengths, whence it is removed and put up into "batts" ready for baling.

The process of manufacturing yarn is of a much more complicated nature. The raw cotton is first placed in a very large scutching machine, which occupies of itself one entire room; the scutcher is composed of a large number of rollers, beaters, fans, &c., and the cotton, in passing through it, is thoroughly cleansed, and pressed, the fans carrying all the dust and refuse beneath the floor and out of the building. This machine coils the cotton into "laps" on large drums, which are carried to another room, where ten large carding machines are in operation, and where the "laps" are run through—the fibres of the cotton being all laid straight and drawn out into what is called a "sliver," which coils of itself directly from each machine into a can. The can is then removed containing the "sliver," and placed at another machine called a draw frame having three "heads" and five "deliverers" to each "head," where the sliver passes through three distinct processes for the purpose of straightening and strengthening it, when it is again coiled into another can. The draw frame is a singularly constructed and self-acting machine—one peculi-

arity being that if any one of the numerous slivers passing through it breaks, the frame, or that section of it through which it is passing, immediately stops and the operative remedies the defect. From the draw frame the cans containing the slivers are removed to the "slubbing frame," which wisps the "sliver" and puts the first twist into it, and where it is run off into large bobbins, and transferred to the "roving frame," which machine twists the cotton into finer threads and transfers it to other bobbins. These bobbins are then carried to another room where the "throstle" frames are in operation and where the sliver receives a still finer twist and is drawn out into the perfect yarn, wound on small bobbins. These bobbins are then conveyed to the reeling machines where the yarn is put into hanks, and afterwards pressed and packed ready for market.

The description we have given above of the process of manufacturing the batting and yarn from the raw cotton as imported from the place of growth, can convey but a slight idea of the complicated nature of the operations through which it requires to pass before completed, but the outline we have given will afford the reader who may never have seen the process an inkling thereof.

The machinery in the works has been imported from the best manufacturers in England, and is certainly beautiful to look at—everything being perfect and very highly finished. Mr. Wright can now turn out ready for market every week with the machinery he has now in operation, 120 bales of batting, weighing from three to four thousand pounds, and 6000 lbs of yarn; and it is his intention, we understand, to add other branches of cotton manufacture to his already extensive establishment in the course of a few months. We wish him every success in his new undertaking, and hope he may realize his most sanguine expectations as to the success of his enterprize. His perseverance and untiring assiduity as a man of business entitle him to much praise, and we doubt not but his Works will earn for their proprietor a first place amongst the manufacturers of Canada.

In speaking of the quality of goods manufactured by Mr. Wright the *Globe* says:

Canadian Cotton Yarn.—We had the opportunity yesterday of inspecting samples of the first lot of cotton yarn manufactured in this Province, the product of the factory of Mr. Jos. Wright, Dundas. The sample, compared with the American yarn, was even, uniform in texture, and in strength superior.—Good judges of the article speak of it in the highest manner. The rate at which it can be manufactured and sold is as low, if not lower, than the imported article, which is much inferior in quality. We are glad to notice that the patient enterprize which Mr. Wright has displayed, during the past year-and-a-half, at length promises a profitable return; and we are sure every Canadian dealer and consumer will give his wares the preference over the imported article.

ON THE CHEMICAL HISTORY OF A CANDLE.

BY M. FARADAY, D.C.L., F.R.S.

From the Chemical News, Feb. 2nd, 1861.

Lecture V.—Oxygen present in the Air—Nature of the Atmosphere—Its Properties—Other Products from the Candle—Carbonic Acid—Its Properties.

We have now seen that we can produce hydrogen and oxygen from the water that we obtained from the candle. Hydrogen, you know, comes from the candle, and oxygen, you believe, comes from the air. But then you have a right to ask me, "How is it that the air and the oxygen do not equally well burn the candle?" If you remember what happened when I put a jar of oxygen over a piece of candle, you recollect there was a very different kind of combustion to that which took place in the air. Now, why is this?—it is a very important question, and one I shall endeavour to make you understand; it relates most intimately to the nature of the atmosphere, and is most important to us.

We have several tests of oxygen besides the mere burning of bodies; you have seen a candle burnt in oxygen, or in the air; you have seen phosphorous burnt in the air, or in oxygen, and you have seen iron filings burnt in oxygen. But we have other tests besides these, and I am about to refer to one or two of them for the purpose of carrying your conviction and experience further. Here you have a vessel of oxygen. I will show its presence to you: if I take a little spark and put it into that oxygen you know by the experience you gained the last time we met, what will happen,—if I put that spark into the jar it will tell you whether we have oxygen here or not. Yes! We have proved it by combustion; and now here is another test for oxygen, which is a very curious and useful one. I have here two jars full of gas, with a plate between them to prevent their mixing; I take the plate away, and the gases are creeping one into the other. "What happens," say you, "they together produce no such combustion as was seen in the case of the candle." But see how the presence of oxygen is told by its association with this other substance. What a beautiful, curious gas I have obtained in this way, showing me the presence of the oxygen. In the same way we can try this experiment by mixing common air with this test-gas. Here is a jar containing air—such air as the candle would burn in, and here is a jar or bottle containing the test-gas. I let them come together over water, and you see the result: the contents of the test-bottle are flowing into the jar of air, and you see I obtain exactly the same kind of action as before, and that shows me that there is oxygen in the air,—the very same substance that has been already obtained by us from the water produced by the candle. But then, beyond that, how is it that air does not burn the candle as well as oxygen will? We will come to that now. I have here two jars; they are filled to the same height with gas, and the appearance to the eye is alike in both, and I really do not know at present which of these jars contains oxygen and which contains air, although I know they have previously been filled with these gases. But here is our test-gas, and I am going to work with the two jars, in order to examine whether there is any difference between them in the quality of reddening this gas. I am now going to turn this test-gas out into one of the jars, and observe what happens:—There is reddening you see; there is then oxygen present. We will now test the other jar, but you see this is not so bright, not so red, not so distinct, as the first; and, further, this curious thing happens, if I take these two gases and shake them together well with water, we shall absorb the red gas; and then if I put in more of this test-gas and shake again we shall absorb more, and I can go on as long as there be any oxygen present to produce that effect. If I let in air it will not matter, but the moment I introduce water, the red gas disappears, and I may go on in this way, putting in more and more of the test-gas, until I come to something left behind which will not redden any longer by the use of that particular body that rendered the air and the oxygen red. Why is that? You see in a moment it is because there is, besides oxygen, something else present which is left behind.

I will let a little more air into the jar, and if it turns red you will know that some of that reddening gas is still present, and that, consequently, it was not for the want of this producing body that that air was left behind.

Now, you will begin to understand what I have got to say. You saw that when I burnt phosphorous in a jar, as the smoke produced by the phosphorous and the oxygen of the air condensed, it left a good deal of gas unburnt, just as this red gas left something untouched,—there was, in fact, this gas left behind which the phosphorous cannot touch, which the reddening gas cannot touch, and this is something which is not oxygen, and yet is part of the atmosphere.

So that is one way of opening out air into the two things of which it is composed,—oxygen, which burns our candles, our phosphorous, or anything else, and this other substance which will not burn them. This other part of the air is by far the largest part. Now, this substance is a very curious thing when we come to examine it; it is remarkably curious, and yet you say, perhaps, that it is very uninteresting. It is uninteresting in some respects because of this,—that it shows no bright appearance of combustion. If I test it with a taper as I do oxygen and hydrogen, it does not burn like hydrogen, nor does it make the taper burn like oxygen. Try it in any way I will, it does neither the one thing or the other; it will not take fire: it will not let the taper burn; it puts out the combustion of anything. There is nothing that will burn in it in common circumstances. It does not smell; it is not sour; it does not dissolve in water; it is neither an acid or alkali; it is as indifferent to all our organs as it is possible for a thing to be. And you might say, "It is nothing; it is not worth chemical attention; what does it do in the air?" Ah! then come our beautiful and fine results shown us by an observant philosophy. Suppose, in place of having nitrogen, or nitrogen and oxygen, we had pure oxygen as our atmosphere. What would become of us? You know very well that a piece of iron lit in a jar of oxygen goes on burning to the end. When you see a fire in an iron grate, imagine where the grate would go to if the whole of the atmosphere were oxygen. The grate would burn up more powerfully than the coals; for the iron of the grate itself is even more combustible than the coals which we burn in it. A fire put into the middle of a locomotive would be a fire in a magazine of fuel, if the atmosphere were oxygen. The nitrogen lowers it down and makes it moderate and useful for us, and then with all that it takes away with it the fumes that you have seen produced from the candle, disperses them throughout the whole of the atmosphere, and carries them away to places where they are wanted to perform a great and glorious purpose of good to man, for the sustenance of vegetation; and thus does a most wonderful work, although you say, on examining it, "why it is a perfectly indifferent thing." This nitrogen in its ordinary state, is an inactive element; no action short of the most intense electric force, and then in the most infinitely small degree, can cause the nitrogen to combine directly with the other element of the atmosphere, or with other things round about it; it is a perfectly indifferent, and therefore to say, a safe substance.

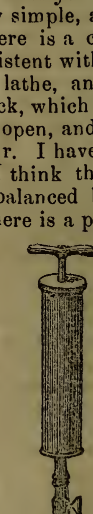
But before I take you to that result, I must tell you about the atmosphere itself; I have written on this diagram, the composition of one hundred parts of atmospheric air:—

	Bulk.	Weight.
Oyxgen	20	22·3
Nitrogen............	80	77·7
	100	100 0

it is a true analysis of the atmosphere, so far as regards the quantity of oxygen and the quantity of nitrogen present. By our analysis, we find that five pints of the atmosphere contains only one pint of oxygen, and 4 pints or 4 parts of nitrogen by bulk. That is our analysis of the atmsphere. It requires all that quantity of nitrogen to reduce the oxygen down, so as to be able to supply the candle properly with fuel, so as to supply us with an atmosphere which our lungs can healthily and safely breathe; for it is just as important to make the oxygen right for us to breathe, as it is to make the atmosphere right for the burning of the fire and the candle.

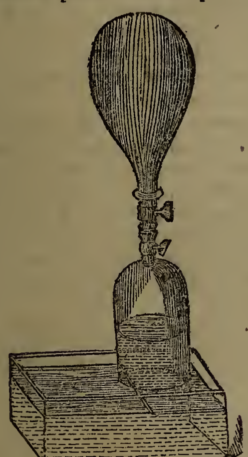
But now for this atmosphere. First of all let me tell you the weight of these gases. A pint of nitrogen weighs 10 grains and $\frac{4}{10}$ths, or a cubic foot weighs $1\frac{1}{6}$ oz. That is the weight of the nitrogen. The oxygen is heavier; a pint of it weighs $11\frac{9}{10}$grs., and a cubic foot weighs $1\frac{3}{8}$ oz. A pint of air weighs about $10\frac{7}{10}$grs., and a cubic foot $1\frac{1}{5}$ oz.

You have asked me several times, and I am very glad you have, "How do you weigh gases?" I will show you; it is very simple, and easily done. Here is a balance, and here is a copper bottle made as light as we can consistent with due strength, turned very nicely in the lathe, and made perfectly air-tight, with a stop-cock, which we can open and shut, which at present is open, and, therefore, allows the bottle to be full of air. I have here a nicely-adjusted balance in which I think the bottle, in its present condition, will be balanced by the weight on the other side. And here is a pump by which we can



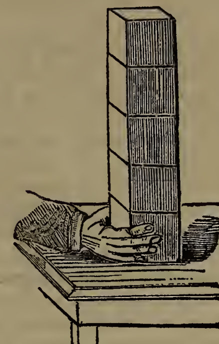
force the air into this bottle, and with it we will force in a certain number of volumes of air as measured by the pump [Twenty measures were pumped in]. We will shut that in and put it in the balance. See how it sinks; it is much heavier than it was. By what? By the air that we have forced into it by the pump. There is not a greater *bulk* of air, but there is the same bulk of *heavier* air, because we have forced in air upon it. And that you may

have a fair notion in your mind as to how much this air is, here is a jar full of water. We will open that copper vessel into this jar, and let the air return to its former state. All I have to do now is to screw them tightly together, and to turn the taps, when there, you see, is the bulk of the twenty pumps of air which I forced into the bottle; and to make sure that we have been quite correct in what we have been doing, we will take the bottle again to the balance, and if it is now counterposed by the original weight, we shall be quite sure we have made our experiment correctly. It is balanced; so, you see, we can find out the weight of the extra volumes of air forced in in that way, and by that means we are able to ascertain that a cubic foot of air weighs $1\frac{1}{8}$ oz. But that small experiment will by no means convey to your mind the whole literal truth of this matter. It is wonderful how it accumulates when you come to larger volumes. This bulk of air [a cubic foot] weight $1\frac{1}{10}$ oz. What do you think of the contents of that box above there which I have had made for the purpose? The air which is within that box weighs one pound—a full pound, and I have



calculated the weight of the air in this room,—you would hardly imagine it, but it is above a ton. So rapidly do the weights rise up, and so important is the presence of the atmosphere, and of the oxygen, and the nitrogen in it, and the use it performs in conveying things to and fro from place to place, and carrying bad vapours to places where they will do good instead of harm.

Having given you that little illustration with respect to the weight of the air, let me show you certain consequences of it. You have a right to them because you would not understand so much without it. Do you remember this kind of experiment: have you ever seen it? Suppose I take a pump somewhat similar to the one I had a little while ago to force air into the bottle, and suppose I place it in such a manner that by certain arrangements I can apply my hand to it. My hand moves about in the air so easily that it seems to feel nothing, and I can hardly get velocity enough by any motion of my own in the atmosphere to make sure that there is much resistance to it. But, when I put my hand here [on the air pump receiver, which was afterwards exhausted] you see what happens. Why is my hand fastened to this place, and why am I able to pull this pump about? And see! how is it that I can hardly get my hand away? Why is this? It is the weight of the air—the weight of the air that is above. I have another experiment here which I think will explain to you more about it.



When the air is pumped from underneath the bladder which is stretched over this glass, you will see the effect in another shape; the top is quite flat at present, but I will make a very little motion with the pump, and now look at it,—see how it has gone down, see how it is bent in; you will see the bladder go in more and more, until, at last, I expect it will be driven in and broken by the force of the atmosphere pressing upon it [the bladder, at last, broke with a loud report]. Now, that was done entirely by the weight of the air pressing on it, and you can easily understand how that is. The particles that are piled up in the atmosphere stand upon each other, as these five cubes do; you can easily conceive that these five cubes are resting upon the bottom one, and if I take that away the others will all sink down. So it is with the atmosphere; the air that is above is sustained by the air that is beneath, and when the air is pumped away from beneath them, the change occurs which you saw when I placed my hand on the air-pump, and which you saw in the case of the bladder, and which you shall see better here. I have tied over this jar a piece of sheet india-rubber, and I am now about to take away the air from the inside of the jar, and if you will watch the india-rubber—which acts as a partition between the air below and the air above, you will see when I pump how the pressure shows itself. See where it is going to, I can actually put my hand into the jar: and yet this result is only caused by the great and powerful action of the air above. How beautifully it shows this curious circumstance.

Here is something that you can have a pull at when I have finished to-day. It is a little apparatus of two hollow brass hemispheres, closely fitted together, and having connected with it a pipe and a cock, through which we can exhaust the air from the inside; and although the two halves are so easily taken apart while the air is left within, yet, you will see when we exhaust it by-and-by, no power of any two of you will be able to pull them apart. Every square inch of surface that is contained in the area of that vessel sustains fifteen pounds by weight, or nearly so, when the air is taken out; and you may try your strength presently in seeing whether you can overcome that pressure of the atmosphere.

Here is another very pretty thing,—the boy's sucker, only refined by the philosopher. We young ones have a perfect right to take toys, and make them into philosophy, inasmuch as now-a-days we are

turning philosophy into toys. Here is a sucker, only it is made of india-rubber; if I clap it upon the table, you see at once it holds. Why does it hold? I can slip it about, and yet if I try to pull it up, it seems as if it would pull the table with it. I can easily make it slip about from place to place; but only when I bring it to the edge of the table can I get it off. It is only kept down by the pressure of the atmosphere above. Here are a couple of them; if you take these two and press them together, you will see how strong they stick. And, indeed, we may use them as they are proposed to be used, to stick against windows or against walls, where they will adhere for an evening, and serve to hang anything on that you want. I think, however, that you boys ought to have experiments that you can make at home; and so here is a very pretty experiment in illustration of the pressure of the atmosphere. Here is a tumbler of water; suppose I were to propose to you to turn that tumbler upside down so that the water should not fall out, and yet not keep it in by my hand, but merely by using the pressure of the atmosphere: could you do that? Take a wine-glass either quite full or half full of water, and put a flat card on the top; turn it upside-down, and then see what becomes of the card and of the water. The air cannot get in because the water by its capillary attraction round the edges keeps it out.

I think this will give you a strong notion of what you may call the materiality of the air, when I tell you that that box holds a pound of it, and this room more than a ton, and you will begin to think that air is something very serious. I will make another experiment to convince you of this positive resistance. There is that beautiful experiment of the pop-gun, made so well and so easily you know out of a quill, or a tube, or anything of that kind; where we take a slice of potato for instance, or an apple, and take the tube and cut out a pellet, as I have now done, and push it to one end. I have made that end tight; and now I take another piece and put it in: it will confine the air that is within the tube perfectly and completely for our purpose; and now I shall find it absolutely impossible by any force of mine to drive that little pellet close up to the other. It cannot be done; I may press the air to a certain amount, but if I go on pressing, long before it come to the second the confined air will drive the front one out with a force something like that of gunpowder; for gunpowder is in part dependent upon the same action that you see in this case.

Here is an experiment which I saw the other day and was very pleased with, as I thought it would serve our purpose here. (I ought to have held my tongue for four or five minutes before I began this experiment, because I depend upon my lungs for the success of it. By the proper application of air I expect I can drive this egg out of one cup into the other by the force of my breath, but if I fail it is in a good cause, and I do not promise success, because I have been talking more than I ought to do to make the experiment succeed.

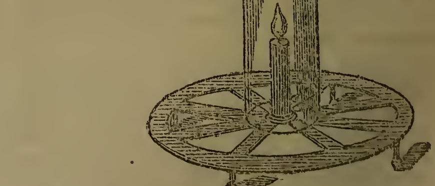
[The Lecturer here tried the experiment, and succeeded in blowing the egg fron one egg-cup to the other.]

You see that the air which I blow goes downwards between the egg and the cup, and makes a blast under the egg, and is thus able to lift a heavy thing for a full egg is a very heavy thing for air to lift. If you want to make the experiment you had better boil the egg quite hard at first, and then you may very safely try to blow it from one cup to the other with a little care.

I think I have now kept you long enough upon this property of the weight of the air, but there is another thing I should like to mention. You saw the way in which, in this pop-gun, I was able to drive the second piece of potato half or two-thirds of an inch before the first piece started, by virtue of the elasticity of the air; just as I pressed in the copper bottle the particles of air by means of the pump. Now this depends upon a wonderful property in the air, namely, its elasticity, and I should like to give you a good illustration of this. It is this: if I take anything that confines the air properly, as this membrane, it is able to contract and expand so as to give us a measure of the elasticity of the air, and to confine in it a certain given portion of air: and then, if we take the atmosphere off from the outside of it, just as in these cases we put the pressure on—if we take the pressure off you will see how it will then go on expanding and expanding, larger and larger, until it will fill the whole of this bell-jar, showing you that wonderful property of the air, its elasticity, its compressibility, and expansibility, to an exceedingly large extent; and this is very essential for the purposes and services it performs in the economy of creation.

We will now turn to another most important part of our subject, remembering that we have examined the candle in its burning, and have found that it gives rise to various products. We have the products, you know, of soot, of water, and of something else, which you have not yet examined. We have collected the water, but have allowed the other things to go into the air. Let us now examine some of these other products.

Here is an experiment which I think will help you in part in this way. We will put our candle there, and place over it a chimney, thus. I think my



candle will go on burning, because the air-passage is open at the bottom and the top. In the first place, you see the moisture coming—that you know about. It is water produced from the candle by the action of the air upon its hydrogen. But besides that, something is going out at the top: it is not moisture,—it is not water,—it is not condensible; and yet, after all, it has very singular properties. You will find that the air coming out of the top of our chimney is nearly sufficient to blow the light out I am holding to it, and if I put the light fairly op-

posed to the current, it will blow it quite out. You will say, that is as it should be, and I am supposing that you think it ought to do so, because the nitrogen does not support combustion, and ought to put the candle out, since the candle will not burn in nitrogen. But is there nothing else there than nitrogen? I must now anticipate,—that is to say, I must use my own knowledge, to supply you with the means that we adopt for the purpose of ascertaining these things, and examining such gases as these. I will take an empty bottle,—here is one,—and if I hold it over this chimney, I shall get the combustion of the candle below sending its results into the bottle above; and we shall soon find that this bottle contains, not merely an air that is bad as regards the combustion of a taper put into it, but having other properties.

Let me take a little quick lime and pour some common water on to it,—the commonest water will do. I will stir it a moment, then pour it upon a piece of filtering paper in a funnel, and we shall very quickly have a clear water proceeding to the bottle below, as I have here. I have plenty of this water in another bottle, but nevertheless I should like to use the lime water that was prepared before you so that you may see what its uses are. If I take some of this beautiful clear lime-water and put that into this jar which has collected the air from the candle, you will see a change coming about. Do you see that that water has got quite milky? Observe, that will not happen with air merely. Here is a bottle filled with air, and if I put a little lime-water into it neither the oxygen nor the nitrogen, nor anything else that is in that quantity of air will make any change in the lime-water, it remains clear and perfect, and no shaking of that quantity of lime-water with that quantity of air in its common state will cause any change; but if I take this bottle with the lime-water and hold it so as to get the general products of the candle in contact with it, in a very short time you see we shall have it milky—there is the chalk, consisting of the lime which we used in making the lime-water, combined with something that came up from the candle,—that other product which we are in search of and which I want to tell you about to-day. This is a substance made visible to us by its action, which is not the action of the lime-water either upon the oxygen or upon the nitrogen, nor upon the water itself, but is something new to us from the candle. And then we find this white powder produced by the lime-water and the vapour from the candle appears to us very much like whitening or chalk, and when examined it does prove to be exactly the same substance as whitening or chalk. So we are led, or have been led, to observe upon the various circumstances of this experiment, and to trace this production of chalk to its various causes to give us the true knowledge of the nature of this combustion of the candle,—to find that this substance issuing from the candle is exactly the same as that substance which would issue from a retort if I were to put some chalk into it and make it red hot with a little moisture: you would then find that exactly the same substance would issue from it as from the candle.

But we have a better means of getting this substance, and in greater quantity, so as to ascertain what its general characters are. We find this substance in very great abundance in a multitude of cases where you would least expect it. All limestones contain a great deal of this gas which issues from the candle, and which we call *carbonic acid.* All chalks, all shells, all corals, contain a great quantity of this curious air. We find it fixed in these stones, for which reason Dr. Black called it "fixed air,"—finding in these fixed things like marble and chalk,—he called it fixed air because it lost its quality of air, and assumed the condition of a solid body. We can easily get this air from marble. Here is a jar containing a little muriatic acid, and here is a taper which, if I put it to that jar, will show only the presence of common air. There is, you see, pure air down to the bottom; the jar is full of it. Here is a substance—marble, a very beautiful and superior marble, and if I put these pieces of marble into the jar, a great boiling apparently goes on. That, however, is not steam; it is a gas that is rising up, and if I now search the jar by a candle I shall have exactly the same effect produced upon the taper as I had from the air which issued from the end of the chimney over the burning candle. It is exactly the same action, and caused by the very same substance that issued from the candle; and in this way we can get carbonic acid in great abundance,—we have already nearly filled the jar. We also find that this gas is not merely contained in marble. Here is a vessel in which I have put some common whitening-chalk which has been washed in water and deprived of its coarser particles, and so supplied to the plasterer as whitening. Here is a large jar containing this whitening and water, and I have here some strong sulphuric acid, which is the acid you might have to use if you were to make these experiments (only in using this acid with limestone, the body that is produced is an insoluble substance, whereas, the muriatic acid produces a soluble substance that does not so much thicken the water). And you will seek out a reason why I take this kind of apparatus for the purpose of showing this experiment. I do it because you may repeat in a small way what I am about to do in a large one. You will have here just the same kind of action, and I am evolving in this large jar carbonic acid exactly the same in its nature and properties as the gas which we obtained from the combustion of the candle in the atmosphere. And no matter how different the two methods by which we prepare this carbonic acid, you will see, when we get to the end of our subject, that it is all exactly the same, whether prepared in the one way or the other.

We will now proceed to the next of our experiments with respect to this gas. What is its nature? Here is one of the vessels full, and we will try it as we have done so many other gases—by combustion. You see it is not combustible, nor does it support combustion. Neither, as we know, does it dissolve much in water, because we collect it over water very easily. Then you know that it has an effect and becomes white in contact with lime-water, and when it does become white in that way, it becomes one of the constituents to make carbonate of lime or limestone.

Now, the next thing is to show you that it does dissolve a little in water, and therefore that it is unlike oxygen and hydrogen in that respect. I have here an apparatus by which we can produce this solution. In the lower part of this apparatus is marble and acid, and in the upper part cold water. The valves are so arranged that the gas can get from one to the other; I will set it in action now, and you

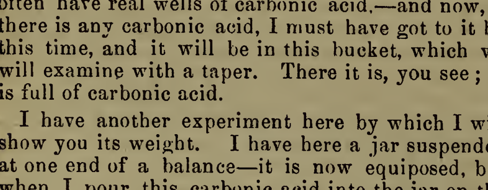
can see the gas bubbling up through the water, as it has been doing all night long, and by this time we shall find that we have this substance dissolved in the water. If I take a glass and draw off some of the water, I find that it tastes a little acid to the mouth ; it is impregnated with carbonic acid ; and if I now apply a little lime water to it, that will give us a test of its presence. This water will make the lime-water turbid and white, which is the carbonic acid test.

Then it is a very weighty gas ; it is heavier than the atmosphere. I have put their respective weights at the lower part of this table, along with, for comparison, the weights of the other gases we have been examining :—

	Pint.	Cubic foot.
Hydrogen . . .	$\frac{3}{4}$ grs	$\frac{1}{12}$ oz.
Oxygen . . .	$11\frac{9}{10}$	$1\frac{1}{3}$
Nitrogen . . .	$10\frac{4}{10}$	$1\frac{1}{6}$
Air	$10\frac{7}{10}$	$1\frac{1}{5}$
Carbonic acid . .	$16\frac{1}{3}$	$1\frac{9}{10}$

A pint of it weighs $16\frac{1}{3}$ grs., and a cubic foot weighs $1\frac{9}{10}$ oz., almost two ounces. You can see by many experiments that this is a heavy gas. Suppose I take a glass cantaining nothing else but air, and this vessel containing the carbonic acid ; and suppose I pour a little of this gas into that glass, I wonder whether any has gone in or not ; I cannot tell by the appearance, but I can in this way [introduces the taper]. Yes, there it is, you see ; and if I were to examine it by lime-water, I should find it in the same way. I will take this little bucket, and put it down into the well of carbonic acid,—indeed we too often have real wells of carbonic acid,—and now, if there is any carbonic acid, I must have got to it by this time, and it will be in this bucket, which we will examine with a taper. There it is, you see ; it is full of carbonic acid.

I have another experiment here by which I will show you its weight. I have here a jar suspended at one end of a balance—it is now equiposed, but when I pour this carbonic acid into the jar on the one side which now contains air, you will see it sink down at once because of the carbonic acid that I pour into it. And now I examine this jar with the lighted taper. I shall find that the carbonic acid has fallen into it, and it no longer has any power of supporting the combustion. If I blow a soap bubble which of course will be filled with air, and let it fall into this jar of carbonic acid, it will float. But I shall first of all take one of these little balloons filled with air I am not exactly sure where the carbonic acid is, we will just try the depth, and see where abouts is its level. There you see we have this bladder floating on the carbonic acid, and if I evolve some more of the carbonic acid, you will see



the bladder lifted up higher. There it goes, the jar is nearly full, and now I will see whether I can blow a soap bubble on that and float it in the same way. [The Lecturer here blew a soap bubble and allowed it to fall into the jar of carbonic acid, when it floated in it midway.] It is floating as the balloon floated by virtue of the greater weight of the carbonic acid than of the air. And now, having so far given you the history of the carbonic acid, as to its sources in the candle, as to its physical properties and weight, when we next meet I shall show you of what it is composed, and where it gets its elements from.

VEGETABLE FOOD.

Food yielding fat and oil is supplied by both the vegetable and animal kingdoms. The distinguishing feature of the following articles of food is the oil they contain :

OLEAGINOUS FOOD.

Under the names of oil, butter, fat, lard, suet, grease, a substance is used largely as an article of food, which differs chemically from starch and sugar in the small quantities of oxygen gas it contains. The composition of these oleaginous substances may be represented generally as follows: Carbon 11 parts, Hydrogen 10 parts, Oxygen 1 part.

Oil differs from the other carbonaceous substances in food in not only supplying materials for maintaining animal heat, but in forming a part of the tissues of the body called fat.

Its action as a heat-giver is greater than starch and sugar, as it supplies hydrogen as well as carbon for burning in contact with oxygen. Its power as a heat-giver compared with these is as two-and-a-half to one. It is very generally present in both animal and vegetable food. The action of oil on the system is not, however, confined to its heat-giving powers. Its seems essential to the development of the fleshy parts of the body. Hence it is found present in the eggs of animals. Fish oil is given in those diseases where a wasting of the flesh is present, as in consumption.

The animal system has the power of converting starch and sugar into fat. All ruminant and hybernating animals become fat in the summer and autumn. The fat thus accumulated is consumed during the winter in maintaining the heat of the body. Man to some extent obeys the same law, and weighs more during the summer than the winter months.

Oils vary in their chemical composition and physical properties. Many vegetable oils, as cocoa-nut oil and olive oil, contain two principles, one of which is liquid, and remains so at all ordinary temperatures; the other is solid when the temperature falls below 40 degrees. The former is called *Oleine*, and the latter *Stearine*. Fats, lards, and butters are composed of the latter, or of principles having the same property.

Oleine, stearine, and other fatty principles consist of acids combined with a base. This base is called *Glycerine*, and is separated from oils in the process of soap-making.

The principal source of oil used as food from the vegetable kingdom is the olive (*Olea Europea*). The seeds of most plants contain oil in addition to starch and other matters. The seeds of the Palm tribe contain much oil, as the Coco-nut palm (*Cocus nucifera*). So also do the seeds of the Cocoa or Chocolate plant (*Theobroma Cacao*).

The following table gives the quantities of oil or fat in one hundred pounds of the more common articles of food:

VEGETABLE FOOD.	
Potatoes	0·2
Wheat Flour	1.2
Barley Meal	0.3
Oatmeal	5.7
Indian Meal	7.7
Rye	1.0
Peas	2.0
Rice	0.7
Beans	2.0
Cocoa	50.0
Lentils	2.0
Buckwheat	1.0
Tea	4.0
Coffee	12.0
ANIMAL FOOD.	
Milk	3.5
Pork	50.0
Veal	16·0
Beef	30·0
Mutton	40·0
Fish	7·0
Cheese	25·0

The olive (*Olea Europea*) is cultivated in the south of Europe. The part of the plant which contains the oil is the fruit. The berries of the olives are pressed, and yield the oil which is so extensively employed on the continent of Europe, and known in this country under the name of Salad Oil. In countries where little butter or fat meat is employed as food, this oil is a most important ingredient in diet.

The seeds of most plants contain oil in addition to starch and other principles. Many seeds are used for obtaining oil for various purposes in the arts, as the poppy, rape, mustard, hemp and flax seeds. The following seeds, eaten as food, contain oil:

Almonds	(*Amygdalus communis*).
Chesnuts	(*Castan a vesca*).
Walnuts	(*Juglans regia* et *Juglans nigra*).
Peccan Nuts	(*Juglans olivœformis*).
Brazil Nuts	(*Bertholletia excelsa.*)
Spanish & Hazel Nuts	(*Corylus avellana*).
Hickory Nuts	(*Carya alba*).
Beech Nuts	(*Fagus sylvatica*).
Pistacio Nuts	(*Pistacia vera*).
Cashew Nuts	(*Anacardium occidentale*).
Chicha Nuts	(*Sterculia Chicha*).
Pine Seeds	(*Pinus Pinea*).

The seeds of many other species of plants are eaten, and the oil they contain is probably their chief recommendation.

Amongst them may be mentioned the various forms of acorns which are eaten in Portugal, Greece, Asia Minor, and other parts of the world. The Sacred Bean of Egypt (*Nelumbium speciosum*), and the Lotos (*Nymphœa Lotos*) of the same region, the Water-nuts (*Trapa natans*) of China and Cashmir, and the Souari or Butter-nuts (*Caryocar butyrosum*) of Demerara.

A bread is made at Gaboon, in Africa, from the seeds of the *Mangifera Gabonensis*, called Dica or Odika bread. By simply boiling in water, from 70 to 80 per cent. of fat can be extracted from this bread. In this respect these seeds resemble Chocolate, and it is not impossible that they might be used in Europe in the same way. They are exceedingly abundant in Gaboon.

The seeds of many of the palms yield large quantities of oil, especially the oil palm (*Elais guineensis*) of Africa. The seed of the cocoa-nut palm (*Cocos nucifera*) is used as a substantive article of diet in Ceylon and many parts of the East Indies. It is imported into this country for the sake of the oil it contains. The milk in the interior of the seed is a bland fluid, and, when the nut is fresh-gathered, is a cool and pleasant drink. In the young state the seeds of most palms are filled with a cool fluid consisting mostly of water. This fluid is drunk by the inhabitants of the countries in which they grow. The double cocoa-nut of the Seychelles Islands (*Loidicea Seychellarum*) contains sometimes as much as fourteen pints of water, and is drunk by sailors touching on these islands with great relish. Even the hard ivory-nut (*Phytelephas macrocarpa*) contains when young a fluid which is drunk by the natives of the countries in which it grows.

Amongst vegetable foods yielding oil the Cocoa or Chocolate plant (*Theobroma Cacao*) is one of the most remarkable. The seeds of this plant contain 50 per cent. of a hard oil or butter.

Food is sometimes preserved in oil which, on account of the small quantity of oxygen it contains, prevents animal or vegetable substances from putrefying. A familiar instance is known in this country in the case of the fish called sardines, which are thus preserved. Oil is used for this purpose in China.

ACIDS.

Many of the organic acids resemble closely in their composition starch and sugar, and may to a certain extent act on the system in the same way. They are therefore referred to the carbonaceous group, but there is no reason to suppose that in any system of diet they could be substituted for any of the other substances in the group. The following paragraphs explain their action:

Organic Acids enter extensively into the composition of various kinds of food. The acids most commonly used in diet are—Acetic acid, Citric acid, Tartaric acid, Malic acid, Oxalic acid.

As articles of diet they probably all act in the same manner on the system. They all exert a solvent power over mineral substances, and assist in carrying the alkalies and alkaline earths into the blood. There is also reason to believe that in certain states of the system they favour the development of the gastric juice in the stomach, and assist, by their decomposition, in oxidising the materials of the blood. In all cases they act medicinally, or as auxiliaries, to the first class of foods.

Acetic Acid, or *Vinegar*, is obtained either from the oxidation of alcohol in fermented liquors, or from the distillation of wood. Common vinegar is obtained from the oxidation of the fermented wort of malt. Vinegar is added to sauces and food to give them a flavour. It also preserves vegetable substances from decomposition, and is used in the manufacture of what are called "Pickles."

Citric Acid is contained in many fruits, but it exists in greatest abundance and purity in the fruits of the Orange tribe (*Aurantiaceœ*). Citric acid is separated from the fruits of these plants in a crystalline form.

Tartaric Acid is found in the juice of the fruits of the Vine tribe (*Vitaceœ*), more especially of the common Vine (*Vitis vinifera*). This acid gives the acidity to the fruit of the grape, and is the acid pre-

sent in wines. It form with potass an insoluble salt, known by the name of cream of tartar.

Malic Acid is contained in the fruits of the Rose tribe (*Rosaceæ*). It has the same general properties as the other acids, and is contained alone in apples and pears, whilst in cherries, plums, &c., it is mixed with other acids.

Oxalic Acid is contained in the Wood Sorrel (*Oxalis acetosella*, also in the common Sorrel (*Rumex acetosa*), and various species of Rhubarb (*Rheum*). Species of the latter genus are extensively cultivated in this country, and the petioles of their large leaves cut up and made into pies, puddings, &c.

The basis of vinegar consists of acetic acid, which is composed of carbon, hydrogen, and oxygen; the same elements that enter into the composition of alcohol. This compound is also procured from the distillation of wood. The acetic acid thus procured is called pyroligneous acid. The quantity of acetic acid in vinegar is from 4 to 5 per cent. Malt vinegar contains, besides acetic acid, water, dextrin, and frequently sulphuric acid. Wine vinegar contains, besides acetic acid, the constituents of the wine from which it is made, as tartaric acid, &c. Pure vinegar is transparent, but burnt sugar is added to give it a colour, on account of a popular prejudice in favour of coloured vinegar.

Various kinds of fruits, leaves, and parts of plants are preserved in vinegar and added to food. Some things are used in this way which are not otherwise employed. This is the case with the caper, which is the fruit of the *Capparis spinosa;* and the Stertion, the fruit of the Indian cress (*Cropœolum majus*). A collection of fruits and plants preserved in vinegar will be found on the shelves devoted to the exhibition of "acids."

Sugar may be converted into vinegar by the aid of vegetation. The so-called "Vinegar Plant," of which a specimen is exhibited in the Museum, is the *mycelium* of a fungus, which, during its growth in sugar and water, decomposes the sugar, and the result is the formation of the vegetable matter of the plant, and the development of acetic acid.

The natural order Aurantiaceæ embraces the Orange, the Lemon, the Citron, the Shaddock, the Pomelot, the Lime, and other fruits. All of them contain citric acid, and varying proportions of sugar.

The flowers of the Orange yield a delicious perfume known as Oil of Neroli.

The juice of these fruits is employed in the Navy for the purpose of preventing scurvy amongst sailors. This effect has been attributed solely to the citric acid, but it has been found that the acid alone does not act so efficaciously as when contained in the juice of the fruit. Hence some writers have attributed the effect to a chemical compound of the acid with other ingredients of the juice.

Citric acid is also found in many fruits, but mixed with other acids, as in the Berberry, Strawberry, &c.

Tartaric Acid forms with potass an insoluble salt, known by the name of Argol, and, when purified, Cream of Tartar. This salt is found in the lees of wine. By burning it the tartaric acid is converted into carbonic acid, and the salt of tartar (carbonate of potash) is made from the tartar of wine. Hence also the name Tartaric Acid. The dried fruits of the Grape (*Vitis vinifera*) are known by the name of "raisins" and "currants."

The Tomato is the fruit of the *Lycopersicum esculentum*, and on account of its acid flavor is used as a sauce.

The edible products of the natural order Rosaceæ, comprising the fruits of the Apple, Pear, Apricot, Nectarine, Peach, Cherry, Plum, Raspberry, Strawberry, contain malic acid. They are mostly preserved in sugar. Many forms of plums called Prunes contain a sufficient quantity of sugar to be dried and preserved without further preparation.—*A Guide to the Food Collection in the South Kensington Museum.*

The Board of Arts & Manufactures

FOR UPPER CANADA.

The regular quarterly Meeting of the Board will be held on Tuesday, the 2nd day of July, at half past one o'clock, P.M., at the Board Rooms, in the New Hall of the Mechanics' Institute, corner of Church and Adelaide Streets, Toronto.

The Sub-committee will meet at half past eleven o'clock, A. M., on the same day.

W. Edwards,
Secretary.

THE TORONTO MECHANICS' INSTITUTE.

ABSTRACT OF ANNUAL REPORT AND PROCEEDINGS.

The Annual Meeting of this Institution was held on Monday, May 13th; Joseph D. Ridout, Esq., President, in the chair.

The Secretary read the report of the Board of Directors, which was adopted; and the President having appointed scrutineers of the ballot, the election was proceeded with, and resulted in the selection of the following named gentlemen as Office-bearers and Directors for the ensuing year, viz:

Rice Lewis, *President.*
R. A. Harrison, 1*st Vice-President.*
W. Edwards, 2*nd Vice-President.*
John Paterson, *Treasurer.*

Directors: Messrs. W. Hay, J. E. Pell, Jos. D. Ridout, Patrick Freeland, John Cowan, C.W. Bunting, James Litster, W. S. Lee, John Withrow, H. Piper R. J. Griffith and R. McPhail.

The first topic taken up in the report is the membership.

"The Board had hoped to be in a position to report an increase of members during their term of office. Although their hopes in this respect have not been fully realized, the decrease has been so trifling, compared with the two former years, as to justify them in concluding that the Institute has again entered upon a career of prosperity similar to that which it previously enjoyed."

The number of members and subscribers at last annual report, was 626, the total number at present is 620, showing a decrease of six during the year, compared with a decrease of 165 reported last year.

"The Board confidently anticipate a large accession to the membership during the ensuing year, induced by more extensive accommodations, the prospect of large additions both to the library and reading room, and improvement in every other department."

The treasurer's statement shows total receipts from all sources $17,480 13 ; expenditure, $8,428 13 ; balance in hand $9,052,00. The assets and liabilities of the Institute are estimated as follows :

ASSETS:

Balance cash in hand.	$9,052 00	
Members' Subscriptions due ...	128 00	
Rents due	26 37	
Value of Building	32 000 00	
Value of ground (cost)	6,525 00	
Value of Library, Furniture, &c.	4,200 00	
		$51,931 37

LIABILITIES:

Loan on Building and Ground	18,400 00
Clear Assets	$33,531 37

In compliance with the new by-laws of the Institute, the principal portion of the books held by the members were sent in during the week preceding the annual meeting, and a thorough examination of the library was made by the Board. Its condition is thus given :

"The total number of Books in the Library, according to the last Annual Report, was		4,121
Added by purchase during the year		292
Bound up from Reading Room		56
Donations		1
Total		4,470
Worn out, or rendered unfit for circulation during the year	153	
Missing, or worn out during former years, but of which no account had been previously taken, for want of annual examination; and works lost by members, for which payment has been received by the Institute	282	435
Now in Library		4,035

The report recommends that a Conversazione should be held at the opening of the Music Hall, the profits to be devoted exclusively to the purchase of books for the Library.

The Board acknowledges the obligation the Institute is under to those gentlemen who have furnished their respective periodicals to the Reading Room free of charge ; and states that

"This department of the Institute has been well attended during the year, and undoubtedly would have been better appreciated, but for want of room and consequent classification of the periodicals supplied ; the interest, however, taken in the Reading Room augurs well for the future, when the large room with ample accommodation shall be thrown open."

The Reading Room has been supplied during the year with 41 Canadian, 22 British, and 15 American Newspapers and Magazines ; several other British Periodicals have been ordered.

For want of proper accommodation in the present building, and having to devote so much time and attention to the new Hall, but one lecture was delivered in connection with the Institute during the past session.

"An English class established in 1859, under the direction of Mr. Richard Lewis, was re-organized last fall and met for a term of five months. The exercises consisted of lessons in English Grammar, on the analysis of sentences, on composition and rhetoric, and on logic, elocution and public speaking. Mr. Lewis labored zealously for the improvement of his class, which was well attended, and a manifest improvement was the result in all who attended industriously to the studies. It was closed only a week or two since, when the thanks of the class were heartily accorded to Mr. Lewis for the interest he had manifested in the welfare and improvement of its members.

"The class has agreed to meet at intervals through the summer months, so as to continue its organization ready for next session.

"A class for the study of vocal music has recently been established in connection with the Institute, conduced by Mr. C. Pearson, which your Board have reason to believe is making satisfactory progress in its studies.

The Board recommend to their successors, that a large share of attention be given to the formation and conducting of classes in the Institute, especially as ample rooms have been provided in the new Hall for their accommodation.

The report states that a settlement was obtained with the government in August last, "when the sum of $16,000 was accepted for the purpose of covering the cost of alterations and repairs to the new Hall, and for Rent, Insurance, and Interest on the debt, for such time as the building might be expected to be undergoing the necessary repairs and alterations. After various delays from causes which have already been under discussion, the principal works for the completion of the building were given out to contract, and are now, with the exception of the Music Hall, nearly ready for occupation.

The services of the late President, Patrick Freeland, Esq., and of the Hon. G. W. Allan, in obtaining the settlement with the government, are acknowledged with the warmest expression of thanks.

"The Board have leased the set of offices in the south-west corner of the ground floor of the building, for a term of five years, at an annual rent of $300 ; and have also leased three rooms, on the south-west corner of the second story, to the Board of Arts and Manufactures, for its model rooms, and Free Library of reference, for a term of three years, at an annual rent of $240.

"Other rooms, both for permanent and casual rentals, are yet at the disposal of the Institute, from the whole of which a sufficient revenue to meet the annual interest, and insurance on the building, may be anticipated."

An arrangement has been entered into with the "Toronto Electoral Division Society," to hold a joint Exhibition of Arts, Manufactures, and Horticultural and Agricultural products, in the New Hall of the Institute. The Exhibition will open on Monday the 7th of October, and remain open from 10 a. m., to 10 p. m., each day, for two weeks. Nearly one

thousand dollars will be offered in prizes, open to all the Province.

The Institute proposes to hold a Bazaar in connection with the Exhibition, the proceeds to be applied to the purchase of a suitable Organ for the Music Hall, where it will be at all times available for Concerts, Musical Societies, &c.

"Under authority of the Act passed during the last session of the Provincial Legislature, your Board surrendered the original Charter of the Institute, and filed declarations incorporating it under the general Act for the Incorporation of Mechanics' Institutes, chap. 72 Consolidated Statutes of Canada. The new constitution and by-laws adopted under said act have been in force since the first day of September last."

The report strongly urges upon the members the claims the Journal of the Board of Art and Manufactures has on their support; and also recommends that during next year, with the extensive accommodations for classes already referred to, a large number of the members will prepare themselves to compete for diplomas at the Annual Examination proposed to be held by the Board, in May, 1862.

Under the new Constitution and by-laws of the Institute, the office of Secretary and Librarian is made a joint office, filled by the appointment of the Board of Directors, instead of by annual election by the members as heretofore. Mr. George Longman has been appointed to the joint office.

(Signed) Jos. D. Ridout,
President.

PROVINCIAL EXHIBITION.

Rules and Regulations,

Sixteenth Exhibition of the Provincial Agricultural Association, to be held at London, on Tuesday, Wednesday, Thursday and Friday, September 24th, 25th, 26th, and 27th.

"The members of the Agricultural Societies of the several Townships within the County, or Electoral Division or United Counties, wherein the Annual Exhibition may be held, and the members of the said County or Electoral Division Society, shall be also members of the Association for that year, and have member's tickets accordingly; provided the Agricultural Societies of the said Townships, or the Society of the said County or Electoral Division or United Counties, shall devote their whole funds for the year, including the Government Grant, in aid of the Association. The Office-bearers of all County Societies shall have tickets of free entrance during the show.—*By-Law.*"

1. The payment of $1 and upwards constitutes a person a member of the Agricultural Association of Upper Canada for one year; and $10 for life, when given for that specific object, and not as a contribution to the local funds.

2. No one but a member shall be allowed to compete for prizes except in classes, 29, 39, 47, 48, and 59.

3. All entries must be made on printed forms, which may be obtained of the Secretaries of Agricultural Societies, or of Mechanics' Institutes, free of charge. These forms are to be filled up and signed by the exhibitor, enclosing a dollar for membership, and sent to the Secretary of the Association, Board of Agriculture, Toronto, on or before Saturday, August 31st, after which no entries can be taken except in the Horticultural and Ladies' Departments and Foreign Classes.

Exhibitors in these Departments may enter articles up to Monday Evening of the show week, when the Books will be finally closed.

4. *Blood Horses, and thorough-bred Cattle* must be entered, and have their full pedigree properly attested and sent to the Secretary in Toronto, *not later than Saturday, August 24th.* No animal will be allowed to compete as pure bred, unless they possess regular Stud and Herd Book pedigrees, or satisfactory evidence be produced that they are directly descended from such stock. In the class of Durham cattle, particularly, no animal will be entered for competition, unless the pedigree of the same be first inserted in the English or American Herd Book, or in the Upper Canada Stock Register, kept at the office of the Board of Agriculture.

5. Tickets from the Treasurer's office will be furnished each exhibiting member, till Monday evening, Sep. 23rd, which will admit himself only, free to every department of the Exhibition during the Show. Life members admitted free throughout the Exhibition.

No members' tickets will be issued after Monday evening, but those issued up to that time will be good till the close of the show.

Necessary attendants upon stock and articles, belonging to exhibitors, will be furnished with admission tickets with their names written upon them, which ticket will be good at the *Exhibitor's Gate only.*

6. The admission fees to non-members, on Tuesday and Wednesday, will be half-a-dollar, and on Thursday and Friday, a quarter dollar, each time of entering through the gates.

Tickets of admission to those who are not members, will be issued on and after Tuesday morning, at 25 cents each,—two such tickets to be given up at the gates each time of admission, on Tuesday, and Wednesday, and one such ticket on Thursday and Friday, in accordance with the above rates. Children under fourteen years of age, half-price. Carriages to pay one dollar each admission; each occupant, except the driver, to be also provided with the usual admission ticket. Horsemen half a dollar.

7. Every article, other than live stock, exhibited for competition, must be the growth, product, or manufacture of Canada, except in classes 39 and 59. Live stock, except in class 29, must be the *bona fide* property of persons residing in Canada, and must be exhibited in the name of the owner only.

☞ *All Premiums for articles, except Stock, are to be awarded to the manufacturers or producers only.*

8. Articles for exhibition must be on the grounds on Monday, Sep 23, except live stock, which must be there not later than Tuesday at noon.

9. Discretionary premiums will be awarded for such articles as may be considered worthy by the Judges, although not enumerated in the list, and the Directors will determine the amount of premium.

In the Fine Arts and Mechanical department, Diplomas will be awarded—in addition to the money prizes—to any specimen evincing great skill in its production, or deemed otherwise worthy of such a

distinction, on its being recommended by the Judges and approved of by the Committee to whom all such matters shall be referred.

10. In the absence of competition in any of the Classes, or if the stock or articles exhibited be of inferior quality, the judges will exercise their discretion as to the value of the premiums they recommend.

No person will be allowed to interfere with the judges while in the discharge of their duties. Any person so interfering will forfeit any premium which may be awarded them.

11. A General Superintendent will be appointed, who will have the general supervision of the grounds, and the arrangements of the exhibition. He will have an office upon the ground; where all persons having enquiries to make in relation to the arrangements will apply.

No articles or stock exhibited will be allowed to be removed from the grounds, till the close of the exhibition, under the penalty of losing the premiums. The exhibition will close immediately upon the delivery of the President's address on Friday afternoon. An Auctioneer will be on the ground after the premiums are announced, and every facility afforded for the transaction of business.

12. Delegates, Judges and Members of the Press are requested and expected to report themselves at the Secretary's Office, immediately on their arrival.

13. The Judges are to meet at the Secretary's Office on the grounds, on Tuesday, 24th, at noon, to make arrangements for entering upon their duties.

14. The annual meeting of the Directors of the Association will take place on the grounds on Friday morning, 27th, at 10 o'clock.

15. While the directors will take every possible precaution, under the circumstances, to insure the safety of articles sent to the exhibition, yet they wish it to be distinctly understood that the owners must themselves take the risk of exhibiting them; and that should any article be accidentally injured, lost, or stolen, the Directors will give all the assistance in their power towards the recovery of the same, but will not make any payment for the value thereof.

Exhibitors must provide for the delivery of their articles upon the show ground. The Association cannot in any case make provision for the transportation, or be subjected to any expense therefor, either in their delivery at or return from the grounds; all the expenses connected therewith must be provided for by the Exhibitors themselves.

16. The Treasurer will be prepared to commence paying the premiums on Saturday, 28th, at 9 a. m., and parties who shall have prizes awarded them are particularly requested to apply for them before leaving London, or leave a written order with some person to receive them, stating the articles for which prizes are claimed.

N.B.—In case the Directors shall require any particular information in reference to animals or articles taking first prizes, the owners will be expected to transmit it, when requested to do so.

☞The Local Committee will make arrangements with Steamboat and Railroad proprietors for carrying articles and passengers at reduced rates.

Provender will be provided by the Association for live stock at cost price.

Arrangements will be made with the Customs department for the free entry of articles for competition.

Music.—The following prizes, in addition to the list published in the last number of the *Journal*, are offered in competition to instrumental Bands of Music:—

For the Best Canadian Amateur Band consisting of not less than eight performers, of whom there shall not be more than two professional artists		$100 00
2nd.	do	75 00
3rd.	do	50 00

Each Band will be required to execute the following pieces of Music, viz: —The National Anthem; Rule Britannia; a quick step; Waltz; Song; Polka; Set of Quadrilles, and a Medley or Operatic Piece; and to be on the grounds under the direction of the Committee during the continuance of the Exhibition. Bands intending to compete will communicate their intention to the Secretary of the Association, at Toronto, or to the Secretary of the Local Committee, at London, at least a week before the Exhibition commences.

The Board of Arts & Manufactures
FOR LOWER CANADA.

Board Rooms, Mechanics' Hall,
Montreal, 28th May, 1861.

The Board met this day at 3 o'clock, p.m.

Present: J. Redpath, President, in the chair; W. Rodden, Vice President; Dr. Dawson, Messrs. Browne, Bulmer, Chamberlin, Forsyth, Murray, Munro, and McQuestin.

The Minutes of the last meeting were read and approved.

The following Report, from the Sub-Committee, was then read:

The Sub-Committee have the honor to report—That the Secretary has reported, as the result of his labours at Quebec during the past session of Parliament, that the Provincial Government having declared their intention to oppose all legislation for the amendment of the laws relating to Patents of Invention, the bill prepared for that purpose and introduced by Mr. Abbott, M.P.P., for Argenteuil, and printed, was not passed into law. Those portions of it, however, relating to Trade Marks and the Registration of Designs were introduced as a separate bill, into the Legislative Council, by the Hon. Mr. Ferrier. It was taken charge of in the Assembly by the Hon. John Rose, and, with some slight modifications, became law.

No action was taken by the government upon the petition for some measure of sanitary reform, a matter, the urgency and importance of which seems to be little appreciated by the public men of the country.

The bill prepared to amend the act constituting this Board was, after several interviews with members of the government, by Professor Hind on behalf of the Upper Canada Board, and your Vice President and Secretary on behalf of this Board, also confided to the Hon. Mr. Ferrier, and by him intro-

duced in the Legislative Council. At the beginning of the session the Board of Agriculture, through Major Campbell, introduced the bill of last session to amend the act constituting that Board, but without the portions relating to the Boards of Arts and Manufactures. In committee, however, the bill relating to this Board was incorporated with it, and further proceedings upon Mr. Ferrier's bill stayed in the Council. The two bills thus amalgamated passed the Lower House without opposition, and received a 2nd reading in the Council. Having been referred to a committee, however, it was never reported, the committee deeming that the amendments in the constitution of the Board of Agriculture and the abolition of the Provincial Agricultural Association would not be acceptable to the farmers of Upper Canada. The other bill, relating solely to the Boards of Arts and Manufactures, was then moved to a second reading with the assent of the Government, and referred to a committee, where all but the more important clauses were cut out. In its reduced form it received a third reading, and was sent to the Lower House, where, however, the Agricultural influence revenged itself upon the Upper Canada members of the Council representing the Agricultural interest, who had defeated their bill, by refusing to suspend the rules and allow the bill of the Boards of Arts to become law. They declared that both bills should go through, or neither. Your committee refrain from all comment on this proceeding, contenting themselves with simply recording it.

Notwithstanding the urgent representations made of the absolute necessity of an increased grant to enable this Board to perform the functions assigned to it with advantage to the government and public, or with credit to themselves, her Majesty's Provincial advisers did not think that in the present condition of the finances of the country, any increase could be made in the grants. Thus, while the Agricultural Boards have upwards of $100,000 placed at their disposal, to foster that which scarcely needs fostering in Canada, the boards representing the Mechanics and Manufacturers of the country, an interest struggling upwards amid many difficulties, must remain content with $4000 as a mark of the appreciation in which they are held by the government and parliament of the country.

The government also declined to submit any grant in the estimates, for the purpose of having Canada represented in the Great Exhibition of 1862. Your committee cannot express too strongly their sense of the evil done to the country by this, in their opinion, unwise economy. There can be no doubt that nothing has ever given Canada so high a position in the eyes of Europe, as the Exhibition she made of her various products in 1851 and 1855. Till then regarded by the mass of Europeans as a distant semi-barbarous dependency of Britain, with a rigorous climate and barren soil, where nought but savages and outcasts could live, and nought but furs and timber could be procured. She showed on these occasions how great her resources were, and, to the astonishment of those who knew her best, took a position which vied with that of old, wealthy and mighty nations. Just at a time when our railway system is in a great measure completed, when our seaports are crowded beyond all previous example with ships seeking cargoes of our products; when the mines of Lower Canada are just being opened up, and there is especial need that the attention of capitalists should be directed towards the splendid opening here for investment in mining adventures, when the *eclat* of the visit of the heir apparent is still fresh in the minds of the people of Britain, to put in an apparent admission that we have already culminated and are beginning to decay, that we can not do as well now as we did ten years ago, is to submit to humiliation, to lose ground, and accept defeat in the contest for industrial rank.

The neglect to appoint a Commission will have this further evil effect, that according to the sixth rule or decision of the Royal Commission, no private parties in any foreign country or colony will be allowed to exhibit, nor will the Commissioners hold communications with any such persons except through Commissioners appointed by their governments. It will therefore be impossible, it is feared, for individual enterprise in any way to remedy this neglect of the government. It is hoped, therefore, that a Commission may yet be appointed to act on behalf of individual contributors who may be desirous of exhibiting specimens of the mineral and other riches of the country. Even if this obstacle did not exist, the Board could not, owing to the scanty funds placed at its disposal, undertake the work.

The report was unanimously adopted.

It was then resolved, that the President (J. Redpath), the Vice President (W. Rodden), Dr. Dawson, and the Secretary (B. Chamberlin), be a committee to wait on Messrs. Galt and Rose, in reference to the interest on the debt of the building, and in regard to an Exhibition. Said committee to report to the Sub-committee. And in the event of the government giving encouragement with reference to the Exhibition of 1862, the Sub-committee is empowered to make the preliminary arrangements, and report at the quarterly meeting.

It was also resolved, that a memorial embodying the views of the Board in reference to the Exhibition in 1862, as expressed in the report just adopted, be prepared and forwarded to the Governor in Council, and that the same be given all possible publicity.

The meeting then adjourned.

B. Chamberlin, *Secretary.*

Correspondence.

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—In the January number of your journal there appeared a programme of a system of Examinations, in various departments of study, of members of Mechanics' Institutes in Upper Canada, proposed to be held annually by the Board of Arts and Manufactures; the first of which was announced to take place in May of the present year.

Not having heard that such an examination has been held, and feeling somewhat curious to know whether any candidates have presented themselves from the fifty or sixty Mechanics' Institutes in this section of the Province, I take the liberty of asking you for information on the subject.

I notice in the number of the *Society of Arts Journal* for May 31st, that the examination by that Society for the present year had been concluded, and that there were thirty-six successful candidates for money prizes, and 653 for first, second and third class certificates.

The subjects for examination were nearly the same as contained in the programme of your Board, and embrace almost every branch of study of value to practical men.

In analysing the occupations of the various candidates to whom the money prizes and certificates were awarded, I find that there were 239 clerks and book-keepers, 60 teachers, 137 mechanics and manufacturers in sixty-four different branches of trade, 35 warehousemen, 28 pupils of Institutes, 8 draughtsmen, 14 chemists, 26 pupils of architects, engineers and surveyors, 24 grocers, drapers and salesmen, 7 revenue, excise and civil service officers, 7 booksellers and stationers, and 4 reporters; and the remainder were gardeners, letter-carriers, artists, dress-makers, miners, housekeepers, farmers, dentists, governesses, agents, messengers, engine drivers, timekeepers, auctioneers, merchants, police constables, and persons engaged in various other industrial pursuits.

I have no doubt but the good effected in England by the establishment of these examinations has been very extensive, as it has brought into active operation a well digested system of class education, in connection with the various mechanics' and other institutes in union with the Society; and has been the means of affording instruction annually to some thousands of the adults and youths of the industrial classes, who, being actively engaged in business, would otherwise have had no favorable opportunities of improving their minds, and fitting themselves for their several occupations.

We cannot hope to see, in our time, as complete organizations of classes by the Institutes here as in England; but still, much may be done if the efforts are only made and persisted in; and when the proposed examinations of the Board shall be successfully carried out, there is no doubt but the holders of its certificates of competency, proficiency, &c., in any particular department of study, will possess very great advantages over their fellows, in the ready obtaining of employment at liberal rates of remuneration.

Yours, &c.,

A Member T. M. I.

Toronto, June 18, 1861.

[No candidates offered themselves at the time appointed, owing, no doubt, to the comparatively short notice given by the Board of the intended examination. We are informed, however, that classes have been organized in some of the Institutes, with a view to preparing themselves for the next session.—Ed. Jour.]

Toronto, 17th May, 1861.

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—I was very much pleased upon the receipt of the May number of your valuable journal, to notice a letter signed "A member T. M. I." I am right glad to see the gauntlet thus thrown down by your correspondent, for I am sure that many will unite with him in saying, "I have been anxiously looking for correspondence on the subject as each issue of the Journal has appeared, but have so far had to look in vain."

I exceedingly regret Mr. Editor that so much apathy should be found to exist among those who interest themselves in the Mechanics' Institutes of Upper Canada; evidently something needs to be done to clothe the "Dry Bones" with life, health and vigour. There is the material Sir, or I should rather say (to continue the figure) there is the body,—the question is, who shall be the first to suggest the means of imparting a healthy tone to it? There are, I doubt not, many Institutes in the Upper Province in good and successful working order, and the question naturally suggests itself how and why they are so? This question is a pertinent one, of considerable importance, inasmuch as they are the exception, instead of being, as they might and should be, the rule. I feel convinced that if we could get together the managers or leading men from the successful and from the unsuccessful Institutes, that in addition to the knowledge the one might be able to impart to the other, they would infuse such a spirit of industry and enterprise into the indolent and lethargic, as would enable them to prosecute with vigour, that with which they are connected.

My plan is then, to form for Upper Canada an union of Mechanics' Institutes, one of the objects of which should be to meet annually or oftener at some central place, in a kind of conference such as is suggested by, "Appendix E, Hand Book of Mechanics' Institutions, by W. H. J. Traice," a copy of which you have in your free Library of Reference, and should be in the possession of every Institute.

I will close by proposing two things. First. That for the benefit of all, you publish in your next number the above mentioned appendix, and Second, that if there are any institutions ready and willing to adopt the proposition as above, (that of union), that they forward to your Secretary a statement to that effect, the names of which

you might publish in the succeeding number of your Journal, and I have no doubt but that in the course of a few months a sufficient number of Institutes would have reponded, to justify the calling of delegates to form the association.

I do hope, Mr. Editor, that the active working officers and members of the Mechanics' Institutes of this Province, will renew their endeavours to teach the hard working and industrious sons of toil, that *knowledge is power*, and learn themselves that *union is strength.*

Another Member,

T. M. I.

[We are pleased to see commenced in the Journal a correspondence relating to the position and objects of the Mechanics' Institutes of the Province, and hope to see the subject well discussed in these pages, so that the views and experiences of those who have taken an active part in the management of these institutions may be imparted to others.

For the information of the writer of the above communication, we would mention that one of the purposes for which the Boards of Arts and Manufactures have been established is the promotion of the interests of the several Mechanics' Institutes in Canada; and that being composed principally of Delegates from these Institutions, with the Presidents of all Incorporated Institutes as *ex-officio* members of the Board, furnishes at once just such an organization as our correspondent suggests.

In August 1858, the executive committee of this Board, in a circular addressed to the Presidents and Delegates of the several Institutes, communicated the following resolution:—

Resolved:—"That the Secretary do request the delegates from the several Mechanics' Institutes to be prepared, at the next Quarterly Meeting of the Board, to discuss the question,—'*What can be done by the Board to promote the efficiency of the Mechanics' Institutes in Upper Canada?*' and also to suggest that meetings of the respective Institutes be held to discuss the question, some time prior to the attending of their Delegates at the meeting of the Board to be held on the 5th of October next."

We regret to say that, notwithstanding the above invitation, no representatives from the Institutes came to the meeting prepared to discuss the question suggested, or to give any information relating thereto. We trust however that it will again be taken up at an early meeting of the Board, and that members will then be prepared to discuss any matters bearing on the interests of these institutions.—Ed. Journal.]

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—I have read with much interest the Reports of Mechanics' Institutes published in your Journal. They bear evidence of progress and effort in the right direction. The establishment of reading rooms and libraries within the reach of the laboring classes, forms an important step in adult education; and the delivery of popular lectures, however general and unsystematic in their order, must give a beneficial impulse to these efforts. The great purpose, however, of these Institutes still remains neglected—the establishment of classes for adult education. This is the most important, as it is no doubt the most difficult work to be accomplished. The news room and library are not used for educational purposes. The library is used for amusement, and works of solid information are very rarely demanded; whilst the patrons of the news room seek its resources for political or general information, or the pastime of a leisure hour. No doubt these branches of a Mechanics' Institute have an important influence on the character of its members; but no Mechanics' Institute is worthy of its name, or the patronage of the friends of progress, which does not offer the advantage of *class instruction* to the working classes. The countless opportunities for making discoveries, inventions and improvements, which lie around them in their daily avocations, are lost, because, notwithstanding all our educational efforts, the great body of the people in every department of labour are ignorant of the principles of physical science. Were our farmers familiar with the elements of agricultural chemistry, our artizans with those of mechanical philosophy, our miners with those of geology, and were these educated to that degree of intelligence which would enable them to communicate to others the suggestions inspired by their avocations, it is impossible to overestimate the advantages that would follow. Instead of inventions and discoveries being isolated and confined to the theorist and the philosopher, they would spring from their natural sources, the field of labour, and be as extensive as the number of experimenters.

Now, the Mechanics' Institute is the college of the people. What an efficient common school system commences, they would continue; and no national system of instruction is complete without this adult college of the people. The common school, under the best conditions, can only supply a general elementary education. The special instruction needed by adults in their different pursuits is acquired best as it is needed, and in the evening classes of a Mechanics' Institute that instruction could be best obtained. Much may be done in this regard by the members forming themselves into mutual instruction classes. But the best amateur teaching is limited and of little value. It is too often unmethodical, uncertain, spasmodical and defective. Thorough instruction must come from the qualified and professional teacher, and we have no right to expect such instruction unless we pay the just value for it. Hence it should be the chief object of the directors of these institutes to encourage and aid the formation of classes, under efficient teachers. The fees should be such as would enable the poorest member to become students; and as it is not probable that these fees would remunerate the teacher, a portion of the funds of the institute, and of all other available resources, whether of benevolent subscriptions or Government aids, should be devoted to this all-important object

The Periodical Examination which the Board of Arts proposes to hold, and the certificates it offers to successful candidates, is of such importance that it ought to receive every encouragement, while the programme of examination at once suggests the proper subjects of study for the classes of a mechanics' institute. In the present depressed circumstances of these institutes, it would be impossible to take up all the subjects; and in making a selection, whilst the tendency would probably be to take up the most practical and necessary—such as arithmetic, mathematics, chemistry, mechanics, drawing and agriculture—the claims of those branches which have relation to the communication and the discipline of thought should not be neglected. The study of English, in all its forms of grammar, composition, and the examination of high-class literature, and the practice of discussion, under judicious management, have the highest claims in the education of the common people, where the common people hold such civic and political power as in this country.

But as the kind of instruction and the management of classes must form a subject of large consideration, I forbear to trespass any further on your columns for the present.

I am, Sir, respectfully yours,

R. L.

Toronto, June 19, 1861.

NOTICES OF BOOKS.

The Metals in Canada. A Manual for Explorers, containing Practical Instructions in Searching for and testing the value of Metallic Ores, with special reference to Canada: By James L. Willson, and Charles Robb, Mining Engineers. Montreal: B. Dawson, & Son. 1 Vol. paper, pp. 80.

This little work is, as its authors profess it to be, a compilation from various learned treatises on the subject of mining, and more particularly from the Reports of the Provincial Geological Survey. It sets forth in a very clear and concise manner the forms and modes of deposit, and other circumstances under which ores of the more useful metals, with the exception of iron, have been or are likely to be found in Canada, together with notices of the most important mines throughout the world that bear analogy to those in this country. It also gives short practical directions for making surface explorations, and for testing and examining many of the metals and minerals.

A work of this kind, small though it be, is likely to prove of great utility not merely to those who are practically engaged in investigations of this nature, but also to all whose attention is directed to the mineral wealth existing in the country. There is no doubt that as long as coal and the precious metals are supposed to be hidden beneath the surface of the earth, requiring only skill and knowledge to bring them forth, the minds of the community are continually harrassed and perplexed by reports of coal mines, veins of silver, and similar discoveries. Under such circumstances, when the public are excited, and individuals are ready upon the slighest grounds to plunge into mining speculations the negative knowledge afforded by works of this description is surely of no slight value. The ability to set at rest such vain expectations, and unfounded opinions on subjects of so great moment to the welfare of the community is undoubtedly by no means unimportant.

"At the present time," as our authors state in their introduction, "a variety of circumstances combine to give an impetus to mining enterprise in this country. The recent discoveries of valuable deposits of copper and lead in the eastern part of the Province, the continued and greatly increased yield of the former metal in the Lake Superior region, and its proportionably diminished production in Cornwall, taken in conjunction with the increasing demand for this article, the removal of the government restrictions on explorations, and greater liberality in regard to grants of land for mining purposes, the recovery from recent great commercial depression, and the universal attention which has lately been directed in England to the development of the resources of this Province." We cannot, in fine, refrain from expressing the gratification we feel at being able to recommend a work of this description, emanating as it does from Canadian pens. It is a pleasing proof that our country is advancing in scientific attainments, and that its great natural resources stand in a fair way of being properly developed.

The Canadian Agriculturist, or Journal and Transactions of the Board of Agriculture for Upper Canada.—Toronto.

We have received the semi-monthly numbers of this excellent publication from the 1st January to the present time, and have invariably found their contents not only instructive and interesting, but well adapted to diffuse a great variety of much needed practical information among the farmers of Canada. Written comment on a Journal which has reached its thirteenth volume is wholly unnecessary, but we may be permitted to express our conviction that the Canadian Agriculturist under its present management will rapidly increase in public favour and estimation; and become a means of diffusing a knowledge of the science and practice of Husbandry, throughout a people at present eminently agricultural in their pursuits, and to a very large extent dependent upon their soil for its support.

Selected Articles.

ON SOME POINTS IN AMERICAN GEOLOGY.

BY T. STERRY HUNT, M.A., F.R.S., OF THE GEOLOGICAL SURVEY OF CANADA.

Concluded from page 166.

Such was the state of the question when Mr. Hall came forward bringing his great knowledge of the sedimentary formations of North America to bear upon the theory of continents and mountains. These were first advanced in his address delivered before the American Association for the Advancement of Science, as its President, at Montreal in August, 1857. This address was never published, but the author's views were brought forward in the first volume of his *Report on the Geology of Iowa*, p. 41, and with more detail in the introduction to the third volume of his *Palæontology of New York*, from which we have taken the abstract already given. He has shown that the difference between the geographical features of the eastern and central parts of North America is directly connected with the greater accumulation of sediment along the Appalachians. He has further shewn that so far from local elevation being concerned in the formation of these mountains, the strata which form their base are to be found beneath their foundations at a much lower horizon than

in the undisturbed hills of the Mississippi valley, and that to this depression chiefly is due the fact that the mountains of the Appalachian range do not, like those hills, exhibit in their vertical height above the sea the whole accumulated thickness of the palæozoic strata which lie buried beneath their summits.

Mr. Hall has made a beautiful application of these views to explain the fact of the height of the Green Mountains over the Laurentides, and of the White Mountains over the former, by remarking that we have successively the Lower and the Upper Silurian strata superimposed on those of the Laurentian system. The same thing is strikingly shown in the fact that the higher mountain chains of the globe are composed of newer formations, and that the summits of the Alps are probably altered sediments of tertiary age. (*Am. Jour. Sci.* xxix. 118.)

The lines of mountain elevation of De Beaumont are, according to Hall, simply those of original accumulations, which took place along current or shore lines, and have subsequently, by continental elevations, produced mountain chains. "They were not then due to a later action upon the earth's crust, but the course of the chain and the source of the materials were predetermined by forces in operation long anterior to the existence of the mountains or of the continent of which they form a part." (P. 86.)

It will be seen from what we have said of Buffon, De Montlosier and Lesley that many of the views of Mr. Hall are not new but old; it was, however, reserved to him to complete the theory and give to the world a rational system of orographic geology. He modestly says, "I believe I have controverted no established fact or principle beyond that of denying the influence of local elevating forces, and the intrusion of ancient or plutonic formations beneath the lines of mountains, as ordinarly understood and advocated. In this I believe I am only going back to the views which were long since entertained by geologists relative to continental elevations." (P 82.)

The nature of the palæozoic sediments of North America clearly shows that they were accumulated during a slow progressive subsidence of the ocean's bed, lasting through the palæozoic period, and this subsidence which would be greatest along the line of greatest accumulation, was doubtless, as Mr. Hall considers, connected with the transfer of sediment and the variations of local pressure acting upon the yielding crust of the earth, agreeably to the views of Sir John Herschel. This subsidence of the ocean's bottom would, according to Mr. Hall, cause plications in the soft and yielding strata. Lyell had already in speculating upon the results of a cooling and contracting sea of molten matter, such as he imagined might have once underlaid the Appalachians, suggested that the incumbent flexible strata, collapsing in obedience to gravity would be forced, if this contraction took place along narrow and parallel zones of country. to fold into a smaller space as they conformed to the circumference of a smaller arc, "enabling the force of gravity, though originally exerted vertically, to bend and squeeze the rocks as if they had been subjected to lateral pressure.*

Admitting thus Herschel's theory of subsidence and Lyell's of plication, Mr. Hall proceeds to inquire into the great system of foldings presented by the Appalchians. The sinking along the line of greatest accumulation produces a vast synclinal, which is that of the mountain ranges, and the result of a sinking of flexible beds will be the production within the greater synclinal and anticlinal axes, which must gradually decline toward the margin of the great synclinal axis. This process the author observes appears to furnish a satisfactory explanation of the difference of slope on the two sides of the Appalachian anticlinals, where the dips on one side are uniformly steeper than on the other. (P. 71.)

An important question here arises, which is this: —while admitting with Lyell and Hall that parallel foldings may be the result of the subsidence which accompanied the deposition of the Appalachian sediments, we inquire whether the cause is adequate to produce the vast and repeated flexures presented by the Alleghanies. Mr. Billings in a recent paper in the *Canadian Naturalist* (Jan. 1860), has endeavored to show that the foldings thus produced must be insignificant when compared with the great undulations of strata, whose origin Prof. Rogers has endeavored to explain by his theory of earthquake waves propagated through the igneous fluid mass of the globe, and rolling up the flexible crust. We shall not stop to discuss this theory, but call attention to another agency hitherto overlooked, which must also cause contraction and folding of the strata, and to which we have already alluded. (*Am. Jour. Sci.* (2) xxx. 138.) It is the condensation which must take place when porous sediments are converted into crystalline rocks like gnesis and mica slate, and still more when the elements of these sediments are changed into minerals of high specific gravity, such as pyroxene, garnet, epidote, staurotide, chiastolite and chloritoid. This contraction can only take place when the sediments have become deeply buried and are undergoing metamorphism, and is, as many attendant phenomena indicate, connected with a softened and yielding condition of the lower strata.

We have now in this connection to consider the hypothesis which ascribes the corrugation of portions of the earth's crust to the gradual contraction of the interior. An able discussion of this view will be found in the *American Journal of Science* (2) iii. 176, from the pen of Mr. J. D. Dana, who, in common with all others who have hitherto written on the subject, adopts the notion of the igneous fluidity of the earth's interior.

We have however elsewhere given our reasons for accepting the conclusion of Hopkins and Hennessy that the earth, instead of being a liquid mass covered with a thin crust, is essentially solid to a great depth, if not indeed to the centre, so that the volcanic and igneous phenomena generally ascribed to a fluid nucleus have their seat, as Keferstein and after him Sir John Herschel long since suggested, not in the anhydrous solid unstratified nucleus, but in the deeply buried layers of aqueous sediments which, permeated with water, and raised to a high temperature, become reduced to a state of more or less complete igneo-aqueous fusion. So that beneath the outer crust of sediments, and surrounding the solid nucleus, we may suppose a zone of plastic sedimentary material adequate to explain all the phenomena hitherto ascribed to a fluid nucleous. (*Quar. Jour. Geol. Society*, Nov. 1859. *Canadian Naturalist*, Dec. 1859 and *Am. Jour. Sci.* (2) xxx. 136.)

This hypothesis, as we have endeavoured to show, is not only completely conformable with what we know of the behaviour of aqueous sediments impregnated with water and exposed to a high temperature, but offers a ready explanation of all the phenomena

* Travels in North America, 1st visit, vol. i. p. 78.

of volcanos and igneous rocks, while avoiding the many difficulties which beset the hypothesis of a nucleus in a state of igneous fluidity. At the same time any changes in volume resulting from the contraction of the nucleus would affect the outer crust through the medium of the more or less plastic zone of sediments, precisely as if the whole interior of the globe were in a liquid state.

The accumulation of a great thickness of sediment along a given line would, by destroying the equilibrium of pressure, cause the somewhat flexible crust to subside; the lower strata becoming altered by the ascending heat of the nucleus would crystallize and contract, and plications would thus be determined parparallel to the line of deposition. These foldings, no less than the softening of the bottom strata, establishes of weakness or of least resistence in the earth's crust, and thus determine the contraction which results from the cooling of the globe to exhibit itself in those regions and along those lines where the ocean's bed is subsiding beneath the accumulating sediments. Hence we conceive that the subsidence invoked by Mr. Hall, although not the sole nor even the principal cause of the corrugations of the strata, is the one which determines their position and direction, by making the effects produced by the contraction not only of sediments, but of the earth's nucleus, itself, to be exerted along the lines of greatest accumulation.

It will readily be seen that the lateral pressure which is brought to bear upon the strata of an elongated basin by the contraction of the globe, would cause the folds on either side to incline to the margin of the basin, and hence we find along the Appalachians, which occupy the western side of such a great synclinal, the steeper slopes, the overturn dips or folded flexures, and the overlaps from dislocation are to the westward, so that the general dip of the strata is to the centre of the basin, on the other side of which we might expect to find the reverse order of dips prevailing, The apparent exceptions to this order of upthrows to the south-east in the Appalachians appear to be due to small down throws to the south-east, which are parallel to and immediately to the north-west of great upheavals in the same direction.

Mr. Hall adopts the theory of metamorphism which we have expounded in the paper just quoted above, *Canadian Naturalist*, Dec. 1859, (see also *Am. Jour. Sci.* (2) xxv. 287, 435, xxx. 135,) which has received a strong confirmation from the late researches of Daubrée. According to this view, which is essentially that put forward by Herschel and Babbage, these changes have been effected in deeply buried sediments by chemical reactions, which we have endeavoured to explain, so that metamorphism, like folding, takes place along the lines of great accumulation. The appearance at the surface of the altered strata is the evidence of a considerable denudation. It is probable that the gneissic rocks of Lower Silurian age in North America were at the time of their crystallization overlaid by the whole of the palæozoic strata, while the metamorphism of carboniferous strata in Eastern New England points to the former existence of great deposits of newer and overlying deposits, which were subsequently swept away.

On the subject of igneous rocks and volcanic phenomena, Mr. Hall insists upon the principles which we were, as far as we know the first to point out, namely their connection with great accumulations of sediment, and of active volcanos with the newer deposits. We have elsewhere said: "the volcanic phenomena of the present day appear, so far as we are aware, to be confined to regions of newer secondary and tertiary deposits, which we may suppose the central heat to be still penetrating, (as shewn by Mr. Babbage,) a process which has long since ceased in the palæozoic regions." To the accumulation of sediments then we referred both modern volcanos and ancient plutonic rocks; these latter, like lavas, we regard in all cases as but altered and displaced sediments, for which reason we have called them exotic rocks. (*Am. Jour. Sci.* (2) xxx. 133). Mr. Hall reiterates these views, and calls attention moreover to the fact that the greatest outbursts of igneous rock in the various formations appear to be in all cases connected with rapid accumulation over limited areas, causing perhaps disruptions of the crust, through which the semi-fluid stratum may have risen to the surface. He cites in this connection the traps with the palæozoic sandstones of Lake Superior, and with the mesozoic sandstones of Nova Scotia and the Connecticut and Hudson valleys.

It may sometimes happen that the displaced and liquified sub-stratum will find vent, not along the line of greatest accumulation, but along the outskirts of the basin. Thus in eastern Canada it is not along the chain of the Notre Dame mountains, but on the north-west side of it that we meet with the great outbursts of trachyte and dolerite, whose composition and distribution we have elsewhere described. (Report of Geological Survey for 1858, and *Am. Jour. Sci.* (2) xxix. 285.)

The North American continent, from the grand simplicity of its geological structure and from the absence, over great areas, of the more recent formations, offers peculiar facilities for the solution of some of the great problems of geology; and we cannot finish this article without congratulating ourselves upon the great progress in this direction which has been made within the last few years by the labors of American geologists.

Montreal, March 1, 1861.

VARNISHES.

(*Concluded from page* 167.)

Brown Varnish.—Rectified spirit 2 gallons; sandarach 3 pounds; shell-lac 2 pounds; pale turpentine varnish 1 quart. Put them into a tin bottle, cork securely and agitate frequently, placing the tin occasionally in hot water till the gum is dissolved, then add a quart of pale turpentine varnish.

Brilliant Amber Spirit Varnish.—Fused amber 4 oz.; sandarach 4 oz.; mastic 4 oz.; highly rectified spirit 1 quart. Expose to the heat of a sand bath, with occasional agitation, till dissolved. The amber is fused in a close copper vessel, haviug a funnel-shaped projection, which passes through the bottom of the furnace by which the vessel is heated.

Crystal Varnish.—Picked mastic 4 oz.; rectified spirit 1 pint; animal charcoal 1 oz. Digest, and filter.

Picture Varnish.—Chio turpentine 2 oz.; mastic 12 oz.; camphor ½ drachm; pounded glass 4 oz; rectified oil of turpentine 3 pints. This is for oil paintings.

Tingry's Essence Varnish.—Powdered mastic 12 oz.; pure turpentine 1½ oz.; camphor ½ oz.; powdered glass 5 oz.; rectified oil of turpentine 1 quart.

Chinese Varnish.—Mastic 2 oz.; sandarch 2 oz.; rectified spirit 1 pint. Close the mattrass with bladder, with a pin hole for the escape of vapor; heat to boiling in a sand or water bath, and when dissolved strain through linen.

Canada Varnish.—Clear balsam of Canada 4 oz.; camphene 8 oz. Warm gently, and shake together till dissolved. This varnish is for maps, drawings, &c., which must be first sized over with a solution of isinglass, taking care that every part is covered. When dry, the varnish is brushed over it.

Common Turpentine Varnish.—This is merely clear pale resin, dissolved in oil of turpentine; usually 5 pounds of resin to 7 pounds of turpentine.

Amber Varnish.—Amber 16 oz.; melt in an iron pot, and add ½ pint of drying linseed oil, boiling hot, and add 3 oz. resin, and 3 oz. asphalte, each in fine powder. Stir till they are thoroughly incorporated; remove from the fire, and add a pint of warm oil of turpentine.

Balloon Varnish.—Melt india-rubber in small pieces with its weight of boiled linseed oil, and thin it with oil of turpentine.

Varnish for Engraving on Copper.—Yellow wax 1 oz.; mastic 1 oz.; asphaltum ½ oz. Melt, pour into water, and form into balls for use. A softer varnish for engravers is made thus: Tallow 1 part, and 2 of yellow wax; or, with 2 oz. wax, 1 drachm common turpentine, and 1 drachm olive oil.

Etching Varnishes.—White wax 2 oz. asphaltum 2 oz. Melt the wax in a clean pipkin, add the asphaltum in powder and boil to a proper consistence. Pour it into warm water, and form into balls, which must be kneaded, and put into taffeta for use.

Another.—White wax 2 oz.; Burgundy pitch ½ oz.; black pitch ½ oz.; melt together, and add by degrees 2 oz. powdered asphaltum, and boil it till a drop cooled on a plate becomes brittle.

Another.—Equal quantities of linseed oil and mastic melted together.

Engraving Mixture for Writing on Steel.—Sulphate of copper 1 oz.; sal ammoniac ½ oz. Pulverise separately, adding a little vermilion to color it, and mix with 1½ oz. vinegar. Rub the steel with soft soap, and write with a hard, clean pen, without a slit, dipped in the mixture.

Etching Fluids.—For Copper.—1. Aquafortis 2 oz.; water 5 oz. Mix.

2. *Callot's Eau Forte for Fine Touches.*—Dissolve 4 parts each of verdigris, alum, sea salt, and sal ammoniac, in 8 parts vinegar; add 16 parts water, boil for a minute, and let it cool.

For Steel.—1. Iodine 1 oz.; iron filings ½ drachm; water 4 oz. Digest till the iron is dissolved.

2. Pyroligneous acid 4 parts by measure; alcohol 1 part. Mix, and add 1 part double aquafortis (sp. gr. 1·28). Apply it from 1½ to 15 minutes.

Varnish for Engraving on Glass.—Wax 1 oz.; mastic ½ oz.; asphaltum ¼ oz.; turpentine ½ drachm.

Another.—Mastic 15 parts; turpentine 7; oil of spike 4.

Le Blond's Varnish.—Keep 4 pounds balsam of copaiva warm in a sand or warm bath, and add 16 oz. of copal, previously fused and coarsely powdered, by single ounces, daily and stir it frequently. When dissolved add a little Chio turpentine.

Sealing Wax Varnish.—Black or colored sealing wax, broken small, and sufficient rectified spirit to cover it; digest till dissolved.

Black Japan.—Boil together a gallon of boiled linseed oil, 8 oz. umber, and 3 oz. asphaltum. When sufficiently cool thin it with oil of turpentine.

Brunswick Black.—Melt 4 pounds asphaltum, add 2 pounds hot linseed oil, and when sufficiently cool add 1 gallon oil of turpentine.

Varnish for Gun Barrels, after browning them.—Shell-lac 1 oz.; dragon's blood ¼ oz.; rectified spirit 1 quart. Dissolve and filter.

Transfer Varnish.—Alcohol 5 oz.; pure Venice turpentine 4 oz.; mastic 1 oz.

Hair Varnish.—Dissolve 1 part of clippings of pig's bristles, or horsehair, in 10 parts of drying linseed oil, by heat. Fibrous materials (cotton, flax, silk, &c.,) imbued with the varnish and dried, are used as a substitute for hair cloth.

Glass Varnish.—This is a solution of soluble glass, and is thus made: Fuse together 15 parts powdered quartz (or fine sand), 10 parts potash, and 1 charcoal. Pulverize the mass, and expose it for some days to the air; treat the whole with cold water, which removes the foreign salts, &c.; boil the residue in 5 parts of water until it dissolves. It is permanent in the air, and not dissolved by water. This varnish is used to protect wood, &c., from fire.

Varnish for Gilded Articles.—Gum-lac 4 parts; dragons's blood 4; annatto; gamboge 4; saffron 1. Dissolve each resin separately in 8 parts alcohol, and make a separate tincture with the dragon's blood and annatto, also in 8 parts alcohol each; then mix the former together, and add a sufficient quantity of the tinctures to give the required shade and color to the varnish.

Gold Varnishes.—Turmeric 1 drachm; gamboge 1 drachm; oil of turpentine 2 pints; shell lac 5 ounces; sandarach 5 oz.; dragon's blood 7 drachms; thin mastic varnish 8 oz. Digest, with occasional agitation, for fourteen days, in a warm place; then set it aside to fine, and pour off the clear.

Another.—Dutch leaf 1 part; gamboge 4; gum dragon 4; proof spirit 18. Macerate for twelve hours, then grind on a stone slab.

Earthenware Varnish.—Flint glass 1 part; soda 1. Mix.

Magilp.—Mastic varnish 1 part; drying oil 2. Mix.

Another.—Mastic varnish 1 part; drying oil 1. Mix.

Another.—Equal parts of mastic varnish, drying oil, and turpentine. Mix.

Metallic Varnish for Coach Work, &c.—Ashphaltum 56 pounds. Melt, then add litharge 9 pounds; red lead 7 pounds; boil, then add boiled oil 12 gallons; yellow resin 12 pounds. Again boil, until in cooling the mixture may be rolled into pills; then add spirit of turpentine 30 gallons; lampblack 7 pounds. Mix well.

Impermeable Varnish.—Boiled oil 100 parts; finely powdered litharge 6 parts; genuine beeswax 5 parts. Boil until sufficiently thick and stringy, then pour off the clear.

Engravers' Stopping-out Varnish.—Take lampblack and turpentine to make a paste.

Varnish for Water Color Drawings.—Canada balsam 1 pint; oil of turpentine 2 warts, mixed. Size the drawing before applying the varnish.

CEMENTS.

Shell-lac Cement, or Liquid Glue.—Fine orange shell-lac, bruised, 4 oz.; highly rectified spirit, 3 oz. Digest in a warm place, frequently shaking, till the shell-lac is dissolved. Rectified wood naphtha may be substituted for spirit of wine, where the smell is not objectionable. This is a most useful cement for joining almost any material.

Shell-lac Cement, without Spirit.—Boil 1 oz. of borax in 16 oz. water; add 2 oz. powdered shell-lac. and boil in a covered vessel till the lac is dissolved. This is cheaper than the above, and for many purposes answers very well. Both are useful in fixing paper labels to tin, and to glass when exposed to damp.

Keller's Armenian Cement, for Glass, China, &c.—Soak 2 dr. of cut isinglass in two oz. of water for 24 hours; boil to 1 oz.; add 1 oz. spirit of wine and strain through linen. Mix this, while hot, with a solution of 1 dr. of mastic in 1 oz. of rectified spirit, and triturate with ½ dr. powdered gum ammoniac, till perfectly homogenous.

Dr. Ure's Diamond Cement,—Isinglass, 1 oz; distilled water, 6 oz; boil to 3 oz., and add 1½ oz. of rectified spirit, Boil for a minute or two, strain, and add, while hot, first, ½ oz. of a milky emulsion of ammoniac, and then 5 dr. of tincture of mastic.

Hoenle's Cement for Glass and Earthenware.—Shell-lac, 2 parts; Venice turpentine, 1 part. Fuse together, and form into sticks.

Cheese Cement, for Earthenware, &c.—Mix together white of egg, beaten to a froth, quick-lime, and grated cheese. Beat them to a paste, which forms an excellent cement.

Curd Cement.—Add ½ pint of vinegar to ½ pint of skimmed milk. Mix the curd with the whites of 5 eggs well beaten, and sufficient powdered quick-lime to form a paste. It resists water, and a moderate degree of heat.

Cement for joining Spar and Marble Ornaments &c.—Melt together 8 parts of resin, 1 of wax, and stir in 4 parts, or as much as may be required, of Paris Plaster. The pieces to be made hot.

Hensler's Cement.—Grind 3 parts of litharge, 2 of recently burnt lime, and 1 of white bole, with linseed oil varnish. This is a very tenacious cement, but it takes a considerable time to dry.

Singer's Cement for Electrical Machines and Galvanic Troughs.—Melt together 5 lbs. of resin, and 1 lb. of beeswax, and stir in 1 lb. of red ochre (highly dried, and still warm), and 4 oz. of Paris plaster, continuing the heat a little above 212°, and stirring constantly till all frothing ceases. Or (for troughs,) resin, 6 lbs; dried red ochre, 1 lb.; calcined plaster of Paris, ½ lb.; linseed oil, ¼ lb.

Composition for welding Cast Steel.—Take of borax 10 parts, sal-ammoniac, 1 part; grind or pound them roughly together; then fuse them in a metal pot over a clear fire, taking care to continue the heat until all spume has disappeared from the surface. When the liquid appears clear, the composition is ready to be poured out to cool and concrete; afterwards, being ground to a fine powder, it is ready for use. * * * To use this composition. The steel to be welded is first raised to a " bright yellow" heat, it is then dipped among the welding powder, and again placed in the fire, until it attains the same degree of heat as before; it is then ready to be placed under the hammer.

Cast-Iron Cement.—Take of clean Iron borings, or turnings, 1 cwt.; of sal-ammoniac 8 oz.: and 1 oz. of flour of sulphur. Mix them thoroughly, and add sufficient water. If the cement is not to be immediately used, care should be taken to keep the mixture soaked in water; if left dry, the cement will heat, and be spoiled.

Cement for Steam Pipe Joints, &c., with Faced Flanges.—To 2 parts of white lead mixed, add 1 part of red lead dry; grind, or otherwise mix them, to a consistence of thin putty; apply interposed layers, with one or two thicknesses of canvass or gauze wire, as the necessity of the case may require.

Glues.—1. A very strong glue is formed by throwing a small quantity of powdered chalk into melted common glue.

2. To make a glue which will resist the action of water—boil one pound of glue in two quarts of skimmed milk.

Botany Bay Cement.—Take one part of Botany Bay gum, and melt and mix it with 1 part of brick-dust.

Cap Cement.—As Singer's; but 1 pound of dried Venetian red may be substituted for the red ochre and Paris plaster.

Bottle Cement.—Resin 15 parts; tallow 4 (or wax 3) parts; highly dried red ochre 5 parts. The common kinds of sealing wax are also used.

Turner's Cement,—Beeswax 1 oz.; resin ½ oz; pitch ½ oz. Melt, and stir in fine brickdust.

Coppersmith's Cement.—Powdered quick-lime, mixed with Bullock's blood, and applied immediately.

PHOTOGRAPHIC SOCIETY OF SCOTLAND.*

The question of printing is one so all important to photographers that too much can hardly be said about it; and I therefore propose addressing to your society a short sketch of my experience on the subject, hoping that, even if it should not contain any important new modification of the processes already known, it may at least assist in unravelling the tissue of confusion in which the beginner finds himself entangled when in search of a process to adopt.

I propose to treat specially of printing on albuminized paper, and that in a purely practical point of view, dividing my subject into several heads, and treating each as curtly as may be consistent with a clear description.

It is hardly necessary to describe at length the operation of albuminizing paper, as few photographers now do this for themselves, the very finest quality of albuminized paper being easily obtained at a rate far below that at which an amateur could make it; besides which the process has been given very fully in almost every manual of photography. It is a great mistake to add acetic acid to the albu-

* On Photographic Printing, by F. Maxwell Lyte, F. C. S.

men, which being in itself alkaline, the addition of the acetic acid gives rise to the development of an acetate, with subsequent formation of acetate of silver on the nitrate bath. This being a very unstable salt, paper which contains it becomes rapidly embrowned in keeping. The dose of salt added to the albumun need not exceed two per cent.

The albuminizing of the paper should be carried on in a dry place, and during dry weather, and the paper itself should be dry before being albuminized: the *eclat* of the proof much depends on this. The paper should not be left on the bath for more than two minutes; if it remains longer, the albumen is liable to run into streaks on drying, and will never have the fine gloss it ought to have; in fact if the albumen does not dry rapidly, and has time to sink into the paper, the proofs will always look dull and faded. The best paper that can be used is that called "papier de Saxe," of which the genuine is imported from Germany; but several of the French manufacturers make a capital imitation of it, which seems nearly, if not quite, to equal the original, and is far cheaper, the real Saxe costing 80fs. the ream, while the imitation may be had for half the money.

It is advisable to keep the paper some time before albuminizing it, as thus many of the little metallic spots disappear by oxidation; but after it is albuminized it cannot be employed too soon, and should be kept in a very dry place; but I have never seen albuminized paper which, even with every precaution did not slightly deteriorate before it had been kept six months. This arises from the fact of the salt disappearing from the surface, where it was at first and becoming imbibed into the web of the paper; so that the sensitive compound of silver forms down in the tissue of the nitrated paper, and the image when printed, being no longer on the surface, does not possess its proper brightness of effect. To sensitize the paper, a solution of nitrate of silver must be made by dissolving that salt in water, in the proportion of 80 or 90 grs. of the former to each ounce of the latter. This solution is to be placed in a convenient dish, and the paper laid face downwards on it, with the usual precautions in order to avoid air-bubbles. The paper should remain on this bath for not less than four minutes, and be then lifted off, drawing it at the same time over a glass rod, which should be held in such a way as to scrape the superfluous liquid from the face of the paper, and cause it to drip back into the dish. Each sheet of paper so sensitized withdraws a portion of silver from the bath; and were more nitrate of silver not added, the bath would soon become too weak. I find in practice that papier de Saxe, prepared with albumen containing two per cent. of salt, requires an addition of one dram of nitrate to the bath for each whole sheet, or parts of a sheet equal to a whole, which has been sensitized on it; and the bath must be filled up with water, so as to bring the bulk of the liquid always up to the same point. Paper when thus sensitized may be hung on a string, by a crooked pin, to dry, or what is better still, suspended in one of the little wooden clips sold for that purpose. After a time it will be found that the bath begins to turn brown and become discoloured; and with a view to correct this, many methods have been proposed, such as the coagulation of the albumen by heat, which in my experience I have found to have no effect, or filtering through animal black, or the addition of kaoline, both of which answer well, but are wasteful and tedious, or the addition of citric acid, which is likewise objectionable, as it soon renders the bath intensely acid, and paper sensitized on it is slow in printing, and has a tendency to turn red, and lastly, the method of Messrs. Girard and Davanne of adding a small portion of solution of common salt, and subsequent filtration, which is the best.

This process I have modified, and I think advantageously so, in the following manner: make a mixture of 3 ounces 5 drachms 2 scruples and 15 grains of crystallized phosphate of soda, with 1 ounce 3 drachms 2 scruples and 15 grains of crystallized carbonate of soda, and pound them together, and keep them in a bottle for use. Of this mixture take two ounces 2 drachms 2 scruples and 5 grains, and dissolve in 30 ounces of distilled water. When it is requisite to decolour a bath which has become coloured by use, all that is necessary is to add some of this solution, in the proportion of one fluidrachm to every pint of the bath. Shake them well up together, and filter, when the liquid will be found to run through quite clear and free from colour. The precipitate and the filter, both of which contain silver, may be added to the other residues, and subsequently worked up again. This treatment slightly impoverishes the nitrate bath; and in order to restore it to its normal state, it becomes necessary to add to it 58 grains of nitrate for every drachm of the solution which has been used. Not only is the bath by this means completely and rapidly decoloured and retained in a neutral condition, but it afterwards never becomes so easily discoloured by albumen.

If prepared paper is meant to be kept some time, it should be placed in a Marion's preservative case; but should the albumen employed have been fresh and the paper of good quality, it will keep perfectly in a dry place for four or five days.

Be careful never to evolve fumes of ammonia or sulphuretted hydrogen in the room where prepared paper is hanging, or it will become discoloured; and for like reason avoid the emanations from stables, &c. &c.

Printing pictures must be regulated by the taste of the operator, only let it be remembered that the strength of the print is always rather diminished during the fixing and toning processes. There have been many and various theories formed on the rationale of the process of printing; the one, however, to which I give the preference is that of Messrs. Girard and Davanne. These gentlemen suppose that when sensitive paper is exposed to the light, and the compound of nitrate and chloride of silver at its surface undergoes decomposition, the cloride of silver becomes reduced to the metallic state with liberation of chlorine, and that this chlorine immediately attacks the free nitrate of silver with which it comes in contract, converting it into fresh chloride of silver, and setting free nitric acid and oxygen. The former is in its turn again decomposed, and more chlorine set free to react as before, while the nitric acid is decomposed in its nascent state by the organic matter of the paper. There is therefore continual decomposition and recomposition going on, till all the free nitrate of silver becomes used up, while successive layers of reduced silver are formed, and super-imposed in the dark parts of the print. In case the sky of a negative has become solarized, which is sometimes unavoidable, it will be necessary

to paint around the outline of the horizon with some opake colour, such as chrome yellow, or vermilion mixed with a little Indian ink, and having printed a proof, to cut out the sky along the line of the horizon. This, being darkened by a few minutes' exposure to the sun, is to be pasted over the sky of the negative with a little varnish, which for this purpose is preferable to gum or paste. This treatment is however often inadmissible, and can never be applied where there are trees in the sky-line. Care must also be taken not to make the paper used in stopping out approach too near to the sky-line, as the thickness of this paper would be liable to prevent the contact of the negative with the positive during printing, and would thus render the proof indistinct in those parts. To avoid this is the object of the painting-line. The same object may be met by carefully paring the edge of the cut-out sky before pasting it down. A pure white sky is often unsightly on a finished proof, and this defect it may be desired to correct: there are three ways of doing so. The first, and best, is by printing in clouds photographed from nature; the next by imitating clouds by means of cotton-wool laid between two glasses; and the third, by making a plain shaded sky. The general principle involved is the same in all three, viz., the application of a negative with natural or artificial clouds, or (in the case of a plain sky) of a clean glass over the proof. The whole is then to be covered with an opake card, and this moved gently up and down over the face of the proof thus exposing that portion of the sky which it is desirable to darken, and shading it gradually down from the top of the proof to the horizon, which should be left white. The card must be kept in constant motion, otherwise a line will be formed across the sky.

Those who are observant of nature may have remarked that the sky, while deep blue over head, seems to fade gradually to a much paler tint towards the horizon. This fact may be profited by to avoid shading the sky too low on the horizon; and thus while the effect is more natural, the danger of destroying the details by darkening the horizon of the picture itself may be avoided. As soon as the print is finished, it must be soaked for at least half an hour in some clean spring water. The object of this is to withdraw most of the free nitrate contained in the proof. From this bath it is to be transferred to another, composed of about a tablespoonful of saturated solution of salt to each pint of water. In this it must remain for not less than a quarter of an hour, and will then be ready for the colouring bath, which is made as follows. Dissolve 200 grains of crystallized phosphate of soda in one pint of water, add to this one ounce of a solution of chloride of gold composed by adding a quarter of an ounce of terchloride of gold to 12 ounces of water;* almost as soon as the proof is placed in this bath, it will be seen to change colour, and pass from the red tone it had assumed in the saline bath to a reddish violet, and then through various shades of violet till it becomes of a bluish-grey tint. The toning may be stopped at any of these shades of colour, according to the taste of the operator, each of them giving a special tone to the fixed and finished proof. For instance, if only left a short time in the toning bath, the proof when finished will incline more or less to red; a longer toning will give it a sepia tint, while, if toned till it becomes grey, a cold grey-black will be the result. From the toning bath the proof should be removed to one of plain water, in which it must from time to time be moved and turned, especially if several proofs are being treated at the same time. I must here recommend the following precautions. While the proof is in the toning bath, let it be frequently turned and kept in constant motion. Let the toning be done by preference in a warm room, as a given quantity of gold will then go further. The same object is hardly attained by warming the solution itself, which seems, it is true, to obtain an increase of activity by this treatment, but becomes, on cooling, proportionately more inactive than ever. Solutions of phosphate of soda and chloride of gold may be kept separately for any length of time without change, but when mixed they should be used as soon as possible; indeed, after a few hours the mixture becomes very slow in its action. Old colouring baths may be mixed with the old hypo, to be treated with other residues.

As the precipitation of gold only takes place on the darkened portions of the proof, it will be found an economical plan to cut round the edges of each picture before toning it, if there should be any dark margin; and these clippings should likewise be kept as residues. The proof after colouring, should be left in the washing water for from half an hour to an hour. This soaking in water is necessary; for otherwise the colour passes off in the hypo, and the proof turns red; the bath of water seems then to have the effect of fixing the colour on the proof. If not frequently turned and moved about in the water, the picture gets stained, and patchy in colour; and again, there may be stains, produced by inequalities or streaks in the albumen itself, which were not apparent before this part of the process. Highly albuminized paper is more slowly toned than the less albuminized variety, but the tones produced are far more rich. The process is quite inapplicable to plain salted paper, which is best coloured by Sutton's sel d'or or the old gold and hypo process.

After this bath of water, the toned proof is to be placed in the hypo bath, composed by dissolving 40 ounces of hyposulphite of soda in a pint of water, and adding a bit of pounded common whiting equal to about the size of a pea. This addition of whiting is made with a view to preventing the hypo from turning acid and decomposing with formation of other compounds, liable to sulphurize the proofs and cause them to fade. The pictures should be left in the hypo for at least two hours, and then taken out and washed in water. Many methods have been proposed for the washing of positives, such as sponging, and all sorts of mechanical contrivances to squeeze out the hypo from the web of the paper; but although they may be efficient where only a few pictures are concerned, I know of no plan equal to the old one of simply changing the pictures from

* It will be found convenient to keep the nitrate of silver, as well as the chloride of gold, in solution. The former may be made of such a strength that every ounce of solution is equal to half an ounce of solid nitrate, by merely putting ten ounces of nitrate of silver into a bottle which holds just a pint, and adding first three-quarters of a pint of water, shaking till the salt is dissolved, and then filling up with water. A still shorter method is to put into a glass any quantity of nitrate of silver, and add to it a *little* more than its own weight of water; then place in the liquid one of the little hydrometers sold in the shops, and called "pese sirops," and add slowly more water stirring all the time. As the water is added the "pese-sirops" will sink lower and lower; and when the liquid stands at 40° on the stem of the instrument, the solution is exactly at 50 per cent., and one ounce is equal to half an ounce of solid nitrate.

one dish to another, renewing the water at each change. All my pictures are treated in this way, and washed for at least twelve hours without intermission; and the process, although laborious, is successful, as I never have a fading picture. After twelve hours' washing, a lot (150 pictures) were soaked in the same water, and frequently agitated and turned in it for four or five hours. This water was then poured off and acidulated with some sulphuric acid, and then carefully evaporated, nearly to dryness; had any trace of hypo been left, free sulphur would have been found in the residue; the latter, however, after being washed on a filter with distilled water, was calcined in a platinum crucible without giving off the least odour of sulphur. I concluded then that no trace of hypo could have remained in these proofs after the washing above mentioned.

The same experiment, tried after washing a like number of proofs for six hours, gave me perceptible traces of sulphur in the residue.

After the picture is washed, there only remains the mounting. For this purpose, take a sheet of thin cardboard, rather larger than the proof, paste it on this, using common paste freshly made, or, what is better, paste made with potato-flour. When dry, the proof must be passed through a satining press, or hot-pressed if possible, and, lastly, fixed in a small wooden frame, made and sold for the purpose, and called a stirator, and rubbed over with the following encaustic:—white wax, 2 ounces; essence of turpentine, 2 ounces; fine copal varnish, ½ to 1 drachm. The wax being melted in a small earthen pot, must be withdrawn from the fire, and the turpentine then added, and last of all the varnish. The proportion of turpentine in this receipt may be varied at pleasure, so as to make the encaustic thicker or thinner at the wi l of the operator. It should be rubbed well into the face of the proof with a bit of flannel, and then the superfluous portion rubbed off with another flannel, till a fine surface is obtained. By this means, not only is the print much protected from being injured by moisture or deleterious gases, but even the finest albuminized proofs are much improved in appearance, and all the deep shades gain in detail.—*Photographic Journal.*

MISCELLANEOUS.

The Coal Trade of Great Britain.

STATISTICS.—The annual return of coals, cinders, culm, and patent fuel shipped coastwise at the several ports of England, Scotland, and Ireland, to other ports of the United Kingdom; and also of the quantities exported to foreign countries and British settlements abroad during 1860, as compared with the preceding year, has just been issued, and shows a slight improvement (about 5 per cent.) in the quantities shipped, whilst the average price per ton has somewhat receded. The subjoined tabulated statement shows the shipments coastwise and the exports during the last two years:

COASTWISE.

	Coals.	Cinders.	Culm.	Total.	Pat. fuel.
	Tons.	Tons.	Tons.	Tons.	Tons.
1859.........	9,913,595	45,991	148,247	10,107,833	29,190
1860.........	10,522,126	40.203	158,387	10,720,716	26.197
Inc.	608,531	....	10,140	612.883	....
Dec.	....	5,788	....	....	2,993

EXPORTS.

	1859.		1860.		Increase.	
	Tons.		Tons.		Tons.	
Coals......	6,784.337	£3,113,487	7,060.388	£3,141,507	276,051	£28,020
Cinders....	213,579	154,419	247,761	171.827	34,182	17.408
Culm......	9,033	2,107	13,683	2,947	4,650	840
Total......	7,006,949	£3,270,013	7,321.832	£3,316.281	314,883	£46.268
Pat. fuel.	75,080	45,266	90,743	55,350	15,663	10,084

For Coals France is still our best customer; but, notwithstanding the existence of the Commercial Treaty of 1860, which was not in force in the preceding year, there has actually been a decrease in the quantity taken by that country from 1,376,890 tons to 1,335,053 tons; whereas a very considerable increase was contemplated. To the United States the shipments have increased from 204,516 tons in 1859 to 309,869 tons in 1860. To Hamburg the exports were 477,587 in 1860 against 473, 130 tons in the preceding year. To Denmark there has been a diminution from 450,556 tons in 1859 to 409,196 tons in 1860. To Italy the increase has been from 347, 326 tons to 442,798 tons. To British India the increase has been from 164,630 tons in 1859 to 289,096 tons in 1860; and to China (including Hong Kong) the increase has been from 93,000 tons to 139,000 tons. Taking a general view of the return, the variations can only be regarded as trifling—a circumstance which may, perhaps, be accounted for by the universal depression which has prevailed having prevented the ordinary increase, and through Australia becoming each year better able to supply herself with mineral fuel.

From an analysis of the statements of quantities exported, and the declared value thereof, it appears that the average price per ton of coal exported has been upwards of 3d. per ton less in 1860 than in the preceding year; the average price per ton in 1859 was rather more than 9s. 2d., whilst that for 1860 was about 8s. 10⅝d. The superiority of the Welsh coal as compared with the North Country coal, appears to be gradually becoming more universally admitted; for although both the Welsh ports and the North Country ports show an improvement, the proportional increase for the Welsh ports is somewhat greater than that for the Northern ports.

The consumption of patent fuel has decreased in this country, but, owing to an augmentation in the export trade, the total shows an increase, amounting to rather more than 10 per cent.—With regard to price, about 2d. per ton more was obtained in 1860 than in the preceding year. The quantity of coals brought into London was, in 1860, coastwise, 3,573,377 tons, against 299,170 tons in 1859; and inland navigation and land carriage, 1,499,899 tons in 1860, against 1,210,776 tons in 1859. The import of patent fuel into London was 18,951 tons in 1860, against 20,642 tons in the preceding year.—*London Mining Journal.*

The Lime Light in London.

The London Journals contain very favourable notices of the new lime light, produced according to an improved principle and arrangement of apparatus. The light is said to be of a pure white color and of dazzling brilliancy, making all the old gas burners in the proximity appear as dull as though they were burning in the bright sunlight of noonday, in comparison. This description of light is so intense that it can be distinctly seen at a distance of ninety five miles. A single jet of the light of medium size, is equivalent to forty argand, or eighty fish-tail gas burners, or to four hundred wax candles; and its intensity and brilliancy may be increased by augmenting the quantity of gas supplied. As compared with the illuminating power of common gas, a single jet, consuming four cubic feet of the mixed gases of hydrogen and oxygen, is said to be equal, in

illuminating power, to that obtained from four hundred feet of ordinary gas. The mode in which the light is produced is by the combustion of lime under the great heat caused by the flame of the mixed gases. A stream of common gas, which is used instead of pure hydrogen, is conducted through one pipe, and a supply of oxygen is sent through a second one, each being attached to separate gas-holders. The pipes terminate near the lamp in one single tube, where the gases are allowed to mix in their way through a curved jet to what is called the wick of the lamp, which is simply a lump of lime, held in close proximity to the mouth of the curved tube by a piece of metal. In lighting the lamp, the first step is to direct the stream of hydrogen upon the lime; it is lighted, and gives forth a small flame of yellow color, soon succeeded by a flame of deep red. When the lime is in this state the oxygen is turned on, and instantly the bright white light is produced.—*Railway Review.*

Danger of Tinned Lead Pipes.

Dr. Frankland, F.R.S , (London) states that he has made several experiments with lead pipes tinned inside, in order to discover if the tin was a preventive of lead corrosion by the water. It was found to be a complete protective, when all the surface was perfectly coated, but the least flaw in the tin coating, if it exposed the lead to the water, was more dangerous than the use of pure lead pipe. The reason given for this is, that a galvanic action is engendered between the two metals, by which the lead is rapidly decomposed, and made to poison the water.—*Scientific American.*

Sheet Zinc for Roofing.

A report of a committee appointed by the Central Society of Architects, in Paris, recommends "that zinc, which was at first rejected, but is now so generally used should be applied with great care, as certain precautions, very simple, but never to be overlooked, are indispensabie. Thus: contact with plaster, which contains a destructive salt, is to be avoided; also, contact with iron, which is very injurious, and liable to cause a rapid oxydation. Eave gutters should always be supported by galvanized brackets, and no gutter or sheet zinc should be laid on oak boards.—*Ibid.*

On the Structure of the Luminous Envelope of the Sun.

Mr. Joseph Sidebotham read a paper, being a communication to him from James Nasmyth, Esq., of Penshurst. Mr. Nasmyth has made the discovery, that the entire surface of the sun is composed of objects of the shape of a willow leaf. These objects average about 1000 miles in length and 100 in breadth, and cross each other in all directions, forming a network. The thickness of this does not appear to be very great, as through the interstices the dark or penumbral stratum is seen, and it is this which gives to the sun that peculiar mottled appearance so familiar to observers. These willow leaf-shaped objects are best seen at the edges of a solar spot, where they appear luminous, on a dark ground, and also compose the bridges which are formed across a spot when it is mending up; the only approach to symmetrical arrangement is in the filaments bordering the spot, and those composing the penumbra, which appears to be a true secondary stratum of the sun's luminous atmosphere. Here these bodies show a tendency to a radial arrangement. Although carefully watched for, no trace of a spiral or vertical arrangement has been observed in these filaments, thus setting aside the likelihood of any whirlwind-like action being an agent in the formation of the spots, as has been conjectured to be the case. The writer does not feel warranted at present in hazarding any conjectures as to the nature and functions of these remarkable willow leaf-shaped objects, but intends pursuing the investigation of the subject this summer, and hopes to lay the results before the British Association during their meeting in this city. The paper was illustrated by three beautiful drawings. No. 1 represented one of the willow leaf-shaped objects; No 2 the luminous surface of the sun as being entirely composed of these objects; and No. 3 a large drawing of a solar spot as seen on the 20th July, 1860, exhibiting the surface of the sun composed of these objects, as also the pennmbra and the bridges across the dark portion of the spot in which the exact shapes of these objects were to be seen most clearly. Mr. Sidebotham stated that the image of the sun was examined by Mr. Nasmyth with a mirror of plane glass, set at an angle of 45 degrees; nearly the whole of the light and heat of the sun passed through the glass, and the rays used were those only reflected from its surface. *Manchester Literary and Philosophical Society March 5th,* 1861.

Carbonic Acid in the Soil.

Van den Broek says (*Annalen der Chem. und Pharm.* Bd. cxv. s. 87) that a solution of carbonic acid percolating through the soil, is, up to a certain limit, robbed of its carbonic acid, so that the filtrate no longer causes any turbidity with lime-water; and, if a stream of hydrogen gas be passed through a layer of earth, the carbonic acid can be displaced. The author lays stress on this property of the soil holding carbonic acid, as supporting Liebig's views on the subject of the nutrition of plants.

Test for the Sulphide of Carbon in Coal Gas.

Dr C Herzog communicates the following to *Chem. Centralblatt*, No 1, 1861, p 1:—Prepare a saturated solution of ammonia in absolute alcohol and a perfectly saturated solution of sugar of lead. Place in a test-tube five drops of the lead solution and about a drachm of the alcoholic ammonia, and allow the gas to bubble through the solution from a narrow glass tube just dipping under the surface. If sulphide of carbon be present in the gas the solution immediately takes an orange colour, and, after a time, a deep brown precipitate falls. If carbonic acid be present as well a white precipitate also is produced. which gives a brighter tinge to the orange colour. For a controlling experiment, the gas may be passed for a short time through the alcoholic ammonia alone, and a couple of drops of the lead solution added afterwards. whereupon, if sulphide of carbon be present, the orange precipitate is produced as before. To free the gas from sulphurretted hydrogen, it may be first passed through a lead solution, which does not affect the sulphide of carbon. The author remarks that the orange precipitate obtained as above, if allowed to remain in the liquid, turns white in twenty-four hours, but if collected on a filter immediately, washed a little, and then dried, it remains of a dark brown colour. The chemical changes which take place when sulphide of carbon is passed into the alcoholic ammonia are, according to the author, rather complex and somewhat variable, but he recommends the test as very simple and practical.

Emeraldine and Azurine.

A Patent for the improvements in the Manufacture of Colouring Matters. By Frederick Grace Calvert, Charles Lowe, and Samuel Clift, Manchester.

This curious patent may be divided into two principal parts, one being the production of a green colouring matter from aniline and its homologues, and the other being the conversion of the green colour into a blue.

The green they call Emeraldine, and the blue Azurine The chemists who devote themselves to colouring matters are said to be at their wits end for names.

The Patentees do not appear to have succeeded in isolating their new colouring matters, for it is specially stated that they are obtained by oxidation in direct contact with the yarn, &c.

In preparing the green colour, they first impregnate the goods with an oxidising agent. They recommend a solution of chlorate of Potash (4 oz. to the gallon), the goods, after steeping, are to be dried and then padded or printed with an acid salt of the base. They prefer a solution of tartrate or hydrochlorate of aniline containing one per cent. of the alkaloid. After the padding or printing, the goods are aged for twelve hours, that time being sufficient for the complete development of the colour.

They also prepare the green by the following modification of the first process:—They mix the oxidising agent with the salt of aniline, and print on both together of course thickening with starch or flour in the usual manner. They recommend the following mixture:—

"Solution of an acid salt of aniline (containing 1 lb. of aniline.)	
Tartrate or chloride of aniline	3 lbs.
Starch or flour paste	60 lbs.
Chlorate of Potash	1 lb.

The chlorate of potash must be dissolved in the starch paste whilst hot, and the solution of the acid salt of aniline we add to it after cooling."

We quote the above literally because it appears to us rather vague. If we understand the directions, they mean that three pounds of a solution of tartrate or "chloride" of aniline are to be taken, which three pounds of solution are to contain one pound of aniline.

The green colour, as produced by the above method, is to be converted into a blue or purple by boiling in a weak solution of soap or alkali, the goods are then to be dried. The soap solution should contain four ounces of printer's soap to the gallon; and the alkaline bath one ounce of caustic soda to the gallon.

The patentees say that instead of the alkaline or soap bath, the goods may be passed through a solution containing one ounce of chromate or bichromate of potash to the gallon of water.

The above colours do not require any mordant.

This patent appears to us to be of great interest. We know that efforts have, for a long time past, been made to apply aniline directly to fabrics, and convert it into colouring matter in the fibre. Some of these efforts have led to dissappointment. If yarn, impregnated with a salt of aniline, be passed into a solution of a chromate or bichromate, it immediately assumes a dirty green colour, which acquires a certain amount of purple tone by treatment with soap. If the aniline solution be strong the goods become nearly black in the chromate bath.—*Chemical News.*

Photography.

Photography is an affair of the present century. Its annals covers scarcely sixty years, and may be divided into three distinct periods:—the first extending from the time when science partially revealed the fascinating secret of light-printing, till the independent and valuable discoveries of Mr. Fox Talbot gave the world an art of sterling utility, where it had before possessed only a few curious experiments; the second comprising the years when, protected by Mr. Talbot's care, and in a great degree popularized by the restrictive powers of his patent, the art made slow advances to maturity; the third reaching down to the present time, from the date when the art somewhat ungraciously burst away from the control of its practical originator. As early as 1802, Sir Humphry Davy and Mr. Wedgwood hit upon a process by which they were able to render paper so sensitive of light that they could produce upon it negative images of objects brought directly in contact with it. They even directed attention to the probable results to be obtained through this sensitive paper and the cooperation of a camera obscura. The pictures, however, produced by Sir Humphry and his coadjutor were transient, and they expressly avowed their ignorance of any means by which the semblances could be rendered permanent. From 1802 till 1834 Sir Humphry's experiments remained, at least as far as the public knew, without being in any way developed or improved upon. In the latter year however Mr. Fox Talbot, by independent investigation and perfectly original experiments, went far beyond the distinguished philosopher. He achieved, like Sir Humphry, pictures, but he also contrived to render them permanent. Mr. Talbot's next step was to discover a process by which he obtained "positives" *from* his "negaitves." On the 8th of February, 1841, William Henry Fox Talbot, of Lacock Abbey in the County of Wilts, Esquire, obtained letters patent for his famous Calotype process. A gentleman of position and wealth, Mr. Talbot made no ungenerous use of his patent. Reserving to himself, as he was well entitled to do, the commercial advantages that might accrue to the parent of so remarkable an invention, he gracefully waived his patent rights in favour of amateur photogaphers, permitting them without let or hindrance to derive all possible enjoyment from the practice of his discovery, so long as they did not employ it for pecuniary gain. At this date it would be nothing short of repulsive injustice to detract from Mr. Talbot's services. He was indeed the father of the photographic profession, as well as the inventor of the photographic art. From his own funds, as well as by his influence with men of science, he created a new field of industry. At a considerable expense he erected workshops and employed assistants. Before, however, he could reap a reward from his outlay, or even reimburse to himself the large sums absorbed by his operations, the invention of the Collodion process by Mr. Archer in 1850, gave the death-blow to his undertakings. In the memorable trial of *Talbot* v. *Laroche* in the Common Pleas, December 1854, it was attempted to establish that the unlicensed practitioners of the Collodion process were guilty of infringing Mr. Talbot's rights. The jury, however, declined to adopt that view of the case; and passing over the Rev. Mr. Reade's discoveries prior to 1841, they gave Mr. Talbot the merit of being, within the meaning of the patent laws, the first and true inventor of the Calotype process; but at the same time they found that in producing pictures by the Collodion process M. Laroche had in no way been guilty of violating Mr. Talbot's patent. The decision was most important to photographers. It was given just as the term of Mr. Talbot's patent was at the point of expiration, and was the cause why that gentleman failed to obtain a renewal of his rights. From that time photography has been free from the fetters of letters patent. If that freedom has been beneficial to the artists, it is no less certain that it has been injurious to the originator of their art. The public can, however, console themselves for this unhappy consequence of a useful decision, by reflecting that to a man in Mr. Talbot's circumstances, the position of a victim for the public good is a comparatively easy lot, and Mr. Talbot has

reason at the same time to congratulate himself that he has not like some inventors, lost the credit of his invention, although, like most inventors, he has acquired but little substantial gain from his ingenuity.—*Photographic Journal.*

On the Chemical Analysis of the Solar Atmosphere.

Kirchhoff has communicated some further results of his remarkable investigations on the constitution of the solar atmosphere. The author maintains that the sun has an ignited gaseous atmosphere, which encloses a core of still higher temperature. If we could see the spectrum of this atmosphere, we should detect the bright lines which are characteristic of the metals existing in it, and should recognise the metals themselves from these. The more strongly luminous body of the sun does not, however, permit the spectrum of his atmosphere to appear. It inverts this spectrum; so that instead of the bright lines which the spectrum of the atmosphere alone would exhibit, dark ones make their appearance. We see, therefore, only the negative image of the spectrum of the sun's atmosphere.

In order to study the solar spectrum with the requisite degree of accuracy, Kirchoff procured from the workshop of Steinheil an apparatus consisting essentially of four large flint-glass prisms and two telescopes.

With this apparatus the spectra are seen in a hitherto unattainable degree of distinctness and purity. It exhibits in the solar spectrum thousands of lines, with such clearness that they are easily distinguished from each other. It is the author's intention to draw the whole spectrum, as seen with his apparatus, and he has already done this for the portion which lies between Fraunhofer's lines D and F.

This apparatus exhibits the spectrum of an artificial source of light with the same distinctness as the solar spectrum, provided only that the intensity of the light is sufficient. A common gas-flame, in which a metalic compound evaporates, is usually not sufficiently luminous, but an electric spark gives with the greatest distinctness the spectrum of the metal of which the electrodes consist. A large Ruhmkorff's induction-coil yields electric sparks in such rapid succession that the spectrum can be observed as easily as that of the sun.

A very simple arrangement permits the comparison of the spectra of two sources of light. The rays of one of the sources may pass through the upper half of the vertical slit, while those of another pass through the lower half. When this is the case, one of the two spectra is seen immediately beneath the other, and it is easy to determine whether coincident lines occur in both.

In this manner the author satisfied himself that all the bright lines peculiar to iron correspond to dark lines in the solar spectrum. In the portion of spectrum between D and F, about seventy particularly well-marked lines occur, resulting from the iron in the sun's atmosphere.

Iron is remarkable on account of the great number of distinct lines which it produces in the solar spectrum. Magnesium is interesting because it produces the group of Fraunhofer's lines lying in the green denoted by Fraunhofer by *b*, and consisting of three very strong lines. Very distinct dark lines in the solar spectrum correspond to the bright lines produced by chromium and nickel, and we may, therefore regard the presence of these substances in the sun's atmosphere as proved. Many other metals appear, however, to be wanting in the sun's atmosphere. Silver, copper, zinc, lead, aluminum, cobalt, and antimony have extremely brilliant lines in the spectra; but no distinct dark lines in the solar spectrum correspond to these.

Many metalic compounds do not give in a gas-flame the spectrum of their metal, because they are not sufficiently volatile. In these cases the spectrum may be made to appear by means of the electric spark. It is true that in this case the spectrum of the metal of which the electrodes consist and that of the air in which the spark passes is also seen. To avoid the difficulty arising from the very great number of bright lines of which the spectrum of every electric spark consists, it is necessary to have recourse to a particular arrangement. The electric spark is allowed to pass at the same time between two similar pairs of electrodes, the light of one spark being allowed to pass through the upper, that of the other through the lower half of the slit, so that one spectrum is seen above the other. When the two pairs of electrodes are clean, the two spectra are perfectly similar; when, however, a metalic compound is placed upon one pair, the corresponding spectrum immediately shows the lines belonging to the metal introduced. The author has satisfied himself that in this manner even the metals of the rare earths, yttrium, erbium, terbium, &c., may be recognised most quickly and certainly. It is, therefore to be expected that, by the help of Ruhmkorff's apparatus, the spectral method of analysis may be extended to the detection of all metals. The researches which the author has undertaken, in connexion with Bunsen, will, it is hoped, determine this point. —*Journ. für Prakt. Chemie.*

The United Kingdom, in 1860.

The annual Statistical Abstract for the United Kingdom, prepared by the Board of Trade, and published by the Queen's printers, appears this year in the convenient form of a thin octavo volume. These annual summaries extend from 1841 to the present time, but 1860 is the most remarkable year in the series. We bought and manufactured to an extent unknown before. But then there was a larger population to do it. The population of England and Wales in 1860 was estimated at 20,000,000, and that of Scotland above 3,000,000. The births in the year exceeding the deaths by 298,579, and our prospects are good for the unprecedented number of 381,436 persons married. There are no means of completing this statement by including Ireland, but even if its population should prove to be only 6,000,000 it is probable that the births in the United Kingdom altogether exceeded the deaths by 1,000 a day Emigration took from our shores 128,469 persons in the year, but a large deduction must be made from this for the immigration of the year, of which, however, there is no record. The number of paupers in receipt of relief cannot be given for any one date; in England it was 890,423 at the close of the year. and in Ireland 50,683; in Scotland, on the 14th of May, 78,306—altogether rather more than 1,000,000, out of our population of 29,000,000 or 30,000,000. We were not a pauperised people, or we should not have raised as we did a net revenue of £67,458,093, the largest sum that ever found its way from the pockets of the taxpayers into the exchequer since the close of the great European war, with the single exception of the year 1858 (the Crimean war.)

Comparing 1860 with seven years ago, we have ad-

ded £30,000,000 to the National Debt, and raised our expenditure for the forces from £16 000,000 to £30,000,000, and our civil expenditure from £7,000,000 to above £10,000,000. As for the mode in which the taxation was raised at the two periods we levied nearly £4,000,000 more by Customs and Excise duties last year, but £8,000,000 more from income tax and stamps and taxes; making a considerable difference in the incidence of taxation, because, though the working classes and humbler classes generally pay about two-fifths of the Custom and Excise duties, the upper and middle classes pay the bulk of the direct taxation. But all classes were able to pay more in 1860 than in 1853, though that was a year of extraordinary prosperity. The declared value of the British and Irish produce and manufactures exported was £98,933,781 in 1853; in 1860 it was £135,842,817. The exports to foreign countries rose from £65,601,057 in the former year, to £92,170,560 in the latter; to British possessions from £33,332,724 to £43,672,257. The progress in the cotton trade has far exceeded all others. In 1853 we sent out to clothe the world, 1,584,727,106lbs. of cotton manufactures; in 1860. 2,765,337,118lbs; the declared value of these exports increased from £25,817,248 to £42,141,505.

The tonnage of vessels entered and cleared, with cargoes and in ballast, at the ports of the United Kingdom, was, in 1853 British, 10,268,423; foreign, 8,121,887; in 1860, British, 13,914,923; foreign, 10,774,369. 1016 vessels, of 241,968 tons, were built and registered in the United Kingdom in 1860, and the total number of vessels of the United Kingdom employed in the home and foreign trade (exclusive of river steamers) rose from 18,206, of 3,730,087 tons in 1853, to 20,019, of 4,251,739, in 1860 These vessels employ 171,592 men. Ships brought us from abroad in 1860, no less than 5,880,958 quarters of wheat and 5,086,220 cwt. of wheaten flour; the quantity of British wheat sold in the principal market towns in England was smaller than for years—4,628,257 quarters; but, owing to the price having been low in the early part of the year, the average *Gazette* price of wheat in 1860 was only 53s. 3d. The computed real value of our imports of corn and flour of all kinds was £21,671,918, in 1859 only £18,042,063. The computed real value of our imports was not ascertained until 1854; in that year it was £152,389,053; in 1860 it was £210,648,643.

Orange, Red and Yellow Colors from Coal Tar.

The following is the substance of a patent lately taken out in England by C. Cowper, of London. It relates to a new method of extracting colors from coal tar. The patentee takes a quantity of the solid pitch obtained from coal tar, which is placed in a clay retort and heated until the retort is red. In conducting this operation, a quantity of red-orange and resinous matter distills over toward the end of the operation. This resinous matter is then treated for 24 hours with cold fuming sulphuric acid, which dissolves it. It is now diluted with water, the excess of acid neutralized with chalk and the clear liquor filtered. This solution slightly acidulated and heated colors silk and wool a red-brown.

A beautiful yellow color is also obtained from the coal tar as follows:—Sulphuric acid, as free as possible from nitrous vapors and sulphate of iron, is heated in a water bath, or in a glass or earthenware vessel, to about 190° Fah. The orange-red matter is then added gradually to the extent of about one-ninth the weight of the acid—*i. e.*. nine parts of sulphuric acid to one of the orange-red matter. When it is found that, by throwing a small quantity of this mixture into water, it is dissolved, the heat must be removed. To promote the action of the acid on the coloring matter, the mixture should be continually stirred during the operation by means of a glass spatula. If neutralized by means of carbonate of soda, a yellow dye is obtained principally for dyeing silks, which is purified in the following manner:—The mixture of the coloring matter with sulphuric acid is diluted with water: it is then neutralized by means of carbonate of lime. After having removed the sulphate of lime again by washing and filtering, the yellow solution is heated to boiling point, and small quantities of hydrate of lime are gradually added, until it is found that, by pouring a small quantity of the yellow solution into a solution of protochloride of tin, a brown powder becomes precipitated. The yellow solution is allowed to cool completely. After separating from it the brown precipitate, by filtering and washing, the yellow solution is again heated to boiling point, and is acidulated with pure hydrochloric acid (muriatic acid). A solution of albumen or gelatine is then added, in small quantities, until it is found that the yellow solution when filtered and heated to boiling point, colors silks a pure yellow.—*Scientific American.*

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

THE JOURNAL

OF THE

Board of Arts and Manufactures,

FOR UPPER CANADA.

AUGUST, 1861.

THE COTTON SUPPLY.

British manufacturers, and others interested in the Cotton Trade, have long been alive to the necessity of being able to procure the requisite supply of raw material from more sources than one, in order that they may be insured against all kinds of contingencies,—against bad seasons, and poor crops, as well as against interruptions caused by political disturbances. This necessity has been more especially felt since the outbreak of the recent civil commotions in the United States; the American supply was always exposed to danger from the effect of natural circumstances, but now events which could never have been anticipated have arisen, and threaten to seriously diminish it, if not to put an end to it entirely for some time to come. How the present state of affairs in that country may ėnd it is impossible to conjecture, but at all events there is no doubt that this year's crop will be sadly deficient, since it has to be raised in the face of a war, and to be exported in spite of a blockade. To remedy this threatened deficiency almost all England is at work. Several private companies have been started for the purpose, and are now in active operation, while the Government likewise has not been idle; all its Ministers, Consuls, and agents in the countries capable of producing cotton, have been officially called upon to stimulate its production to the utmost. Last year, at least three-fourths of the raw cotton consumed in England came from the United States, but this year it is expected that more than one-half can be procured elsewhere. The following are the principal companies that have been organized for this purpose:—

"The Manchester Cotton Company, with a capital of $5,000,000, Thomas Bazley, M. P., from Manchester, President. The company started with £500,000, and it was increased to the above sum as soon as the news of secession in America was received.

"Another company has been formed in London, known as the 'Jamaica Cotton Company,' with a capital of £50,000, Samuel Gurney, M.P., chairman. An 'East India Cotton Company' is also formed in London, with a capital of $1,250,000, and some of the leading capitalists of London are connected with it.

"The 'British Cotton Company,' of Manchester, with a capital of $100,000, has also been formed.

"The 'Coventry Cotton Company,' is also formed, with a capital of $250,000.

"The 'Cotton Supply Association' is also vigorously at work, with its arms extended all over the world.—This is an older association, having been organized for four years. The 'African Aid Society,' of London, recently formed, chairman, Lord Alfred S. Churchill, M.P., brother to the Duke of Marlborough. Lord Calthorpe and the Bishop of Sierra Leone are the vice-presidents. Branches of this Association are formed at Glasgow, Manchester, Birmingham, and other towns of Great Britain."

Of these, the "Cotton Supply Association" is by far the most important. It has recently published its fourth annual report, from which may evidently be gathered some very encouraging information. As we have not ourselves seen the document, we cannot do better than subjoin some remarks from the *Times* upon it:—

"Cotton is a plant which can be grown in so very many countries that the mere selection of soil counts for nothing in the problem. There are hundreds of spots in our colonial empire which could produce cotton enough for the whole of Lancashire; but cotton is of various kinds; it requires peculiar preparation for the market, and, as it is bulky in character, facilities of communication enter very largely into the question. It is probably not every cotton country that could produce cotton equal to the Sea Island kind; but the supply of Sea Island cotton is always small. It forms only about 1-50th part of our whole annual supply; so that the question of quality is not a very critical one. The cleaning process is exceedingly important, but that, again, depends only on instruments which can be easily furnished, and dexterity which can be quickly acquired. In the end we come to this, that the whole problem turns upon facilities of transport. In fact, if India had but good roads, the question would be solved for the present; and that is evidently the opinion of the Cotton Supply Association. It is easy to supply good seeds and good cleaning machines, but it is by no means easy to get the cotton from the field to the coast. Carriage is either impracticable altogether, or so tedious and costly as to absorb an enormous proportion of the whole value of the crop.

Another point to be considered is the immense magnitude of the trade, which calls for a corresponding extent of organization. This is where the United States had so great an advantage. They had got the trade in their own hands, and they had gradually brought it to perfection. They supplied the best cotton with infallible punctuality, and in such quantities as almost t suffice for the entire consumption of the country. To organize a commerce like this, must needs be a work of time. It is a question whether any one country could ever do again what the United States have done. India would make the nearest approach to the mark, beyond a doubt; but then comes another question—whether we should not make a point rather of distributing than concentrating our demands. India has far greater capabilities than any other country, but India might be troubled just like America, and all our anxiety would come over again. Four years ago we should have felt a great deal of uneasiness if all our cotton supplies had been drawn from Bombay."

It is certainly cheering to find that so many new sources of supply have been opened, as very little dread need now be entertained respecting the possibility of a complete failure at any future time. The report of the Association enumerates no less than "fifty-eight different parts from which cotton either never came before, or had ceased to come, or came in insignificant quantities, but which have contributed to the supplies with greater or less success-

during the last twelve months." It also relates that they have not neglected to pay attention to quality as well as quantity; the committee of the Association have received upwards of one hundred and fifty samples of cotton from various countries throughout the world, for their inspection and appraisement. In fact—to quote again from the *Times*:—

" The Association has been doing for the last year or two all over the world, what the British Government within the last few months has been doing in India. The Committee could not speak with official authority, but they 'agitated,' 'corresponded,' and set things in motion whenever they saw a chance. They let all manner of people understand that cotton was wanted, and that payment would readily be made for it. They described the kind of cotton required, and made grants of the proper seed. They sent out good gins for cleaning the cotton, and presses for packing it. They were ready, in short, to provide everything except roads, and that the India Government itself found a difficulty in doing.'"

More recent accounts from India, however, state that the difficulties arising from the want of means of transportation are fast disappearing; several railroads are being built into the interior, so that the cotton crop can very soon be moved, as fast as it is gathered, to the sea-coast; and the ship canal across the Isthmus of Suez, from the Red Sea to the Mediterranean, will, it is confidently expected, be completed in twelve months, thus shortening the distance of carriage no less than 6,000 miles. It is even asserted that if the American troubles continue five years, India will be able to export the vast amount of 4,000,000 bales,—a quantity worth about $400, 000,000, thus freeing the English manufacturers from all dependence upon the United States for their supply.

Africa also bids fair to become one of the greatest and best sources of supply. The researches of Dr. Livingstone and other missionaries have revealed the fact that that continent possesses capabilities for the growth and exportation of cotton that can scarcely be surpassed in any other part of the world. " The regularity of the climate, the fact that a new crop can be raised every six months, the adaptation of negro labour to its cultivation, and the ease of its transportation down the large rivers, give Africa peculiar advantages." We learn also that even now the best Western-African cotton can be laid down in Liverpool for four-pence and a farthing per pound, which is cheaper than it can be procured from New Orleans, while at the same time it is of a superior quality. We have already noticed, * in an extract from the *Journal of the Society of Arts*, that cotton can be procured in Queensland, Australia, in large quantities.

From facts like these, then, it can easily be perceived that little or no apprehension need be entertained by the English manufacturers with regard to obtaining the necessary supply of the raw material. But in this country we fear that the manufacture of cotton cannot profitably be carried on, at least in competition with British goods, so long as the supply from the United States is cut off. To procure it from any other quarter would involve a carriage of many additional thousand miles, the cost of which would completely counterbalance any advantage possessed by this country in the way of labor or motive power.

* See the May number of this Journal, p. 140.

AMERICAN COTTON STATISTICS.

An interesting article on " Statistics of Cotton Manufacture," taken from the eleventh annual report of the Boston Board of Trade, by Samuel Batchelder, Esq., has lately been published. We condense the following from its pages :—

In 1860 there were in Massachusetts 1,688,471 spindles and 41,620 looms. Since 1850 there has been a total increase of 31 per cent in the number of spindles; but during the past five years the ratio of the increase has been only 11 per cent, which is much lower than that of the same number of years since 1840.

The consumption of cotton in Massachusetts in 1850 was 95,032,975 pounds, or 73.70 for each spindle; in 1855, the amount consumed was 105,851,749 pounds.

It is stated in this report that there is no positive data by which to determine the present number of spindles in the United States, but according to the census of 1850, there were 272,527,000 pounds of cotton consumed; and by allowing 75 pounds to a spindle, there would have been 3,633,693. "If we add," says Mr. Batchelder, " twenty per cent. for the increase of the next ten years, during which time the spindles in Massachusetts have increased 31 per cent. we shall have 4,380,430 for the number in the United States in 1860."

In Tennessee, Alabama, Georgia and South Carolina, there were 140,602 spindles, according to De Bow, in 1850, and the bales of cotton consumed were 60,000; but statistics for that year make the consumption of bales in these States only 41,778. The report of the Philadelphia board of Trade for 1860 gives the consumption of cotton in States north of Virginia at 760,218 bales, and in States south at 164,700, making a total of 921,918. Mr. Batchelder is of opinion, however, that 900,000 bales is probably nearest the truth.

In 1855 there were 314,996,567 yards of cotton cloth produced in Massachusetts, at a cost, for labor and material, of 7.76 cents per yard. The exportation of American goods is larger than many persons suppose. For the year ending June 30, 1860, the value of such exports amounted to $10,934,796. It is understood that goods to the value of $4,200,000 went directly to China from the ports of New York and Boston. The London *Economist* states that the total cotton goods and yarn exported from Great Britain last year amounted in value to £48,200,000, of which sum the United States took £4,635,000 (about $22, 479,750). We therefore export cotton goods valued at nearly one-half that which we take from England. This is more favorable than most people imagine.

Mr. Batchelder says; " As to the future prospects

of our cotton manufacture, the greatest apprehension seems to be on account of our relations with the Southern States. There is little doubt that we shall be able to obtain our supply of cotton at the market price, unless all the laws of trade are *nullified.*" This is no doubt a sound conclusion, but it affords no satisfaction to any person. Cotton can always be obtained at the *market price*, It is stated that the value of the entire cotton manufactures of the United States in 1850 was $16,869,184, of which $57,134,760 was consumed at home and the rest exported; and of this amount the free States produced $52,502,853. About seven per cent. of this only is supplied to the fifteen slave States. Our foreign exports of cotton goods have increased rapidly. In 1850, they were valued at $4,734,424; the increase in ten years is $6,200,372.

A common opinion prevails that the increase of cotton machinery has kept in advance of the supply of cotton. Mr. Batchelder asserts that this is not the case. He gives some statistics of British manufacture in proof of this opinion. In 1856 the number of spindles in England and Wales was 25,818,576; looms, 275,590. In Scotland—spindles, 2,041,139; looms, 21,624. In Ireland—spindles, 150,502; looms 1,633. The increase of spindles in Great Britain in six years was about 30 per cent. At the present time it is believed that there are 33,612,260 spindles in England, Ireland and Scotland, allowing an increase of 20 per cent for the last four years. The increase of cotton machinery in England has been proportionally greater than in the United States. The average number of spindles to the loom in Great Britain is 84, or about twice the proportion of this country. More cotton is exported in the form of yarn, and the looms are driven with greater speed in England. But the whole increase of cotton machinery in Europe and America, from 1850 to 1860, is stated to be no more than 50 per cent, while the average increase of the cotton crop in the same period has been no less than 64 per cent. Instead of the machinery increasing beyond the power of the cotton crop to supply the spindles (as has been predicted for some years past), the supply of cotton has been increasing beyond the spindles. At the close of 1860 there were 403,000 bales of American cotton in Liverpool. Mr. Batchelder states that he had hoped to obtain from Washington some statistics from the census of 1860; but on application at the Census Bureau, the manufacturing statistics had not been made up so as to afford any information on the subject.—*Scientific American.*

THE CHEMICAL HISTORY OF A CANDLE.

BY M. FARADAY, D.C.L., F.R.S.

From the "Chemical News," February 9th, 1861.

LECTURE VI.—CARBON OR CHARCOAL—COAL GAS—RESPIRATION AND ITS ANALOGY TO THE BURNING OF A CANDLE—CONCLUSION.

A lady who honours me by her presence at these Lectures has conferred a still greater obligation by sending me these two candles which are from Japan, and, I presume are made of that substance to which I referred in a former Lecture. You see that they are even far more highly ornamented than the French candles, and, I suppose are candles of luxury, judging from their appearance. They have a remarkable peculiarity about them, namely, a hollow wick,—that beautiful peculiarity which Argand introduced into the lamp and made so valuable. To those who receive such presents from the East, I may just say that this and such like materials, gradually assume a change which gives them on the surface a dull and dead appearance; but they may easily be restored to their original beauty if the surface is rubbed with a clean cloth or silk handkerchief, so as to polish the little rugosity or roughness; this will restore the beauty of the colours. I have so rubbed one of these candles, and you see the difference between it and the other which has not been polished, but which may be restored by the same process. Observe, also, that these moulded candles from Japan are made more conical than the moulded candles in this part of the world.

I told you, when we last met, a good deal about carbonic acid. We found by the lime-water test that when the vapour from the top of the candle or lamp was received into bottles and tested by this solution of lime-water (the composition of which I explained to you, and which you can make for yourselves), we had that white opacity which was in fact calcareous matter, like shells and corals, and many of the rocks and minerals in the earth. But I have not yet told you clearly and chemically the history of this substance, carbonic acid, as we have it from the candle, and I must now take you to that point. We have seen the products, and the nature of them, as they issue from the candle. We have traced the water to its elements, and now we have to see where are the elements of the carbonic acid supplied by the candle: a few experiments will show this. You remember that when a candle burns badly it burns with smoke; but if it is burning well there is no smoke. And you know that the brightness of the candle is due to this smoke which becomes ignited. Here is an experiment to prove this: so long as the smoke remains in the flame of the candle and becomes ignited it gives a beautiful light, and never appears to us in the forms of black particles. I will light some fuel which is extravagant in its burning; this will serve our purpose—a little turpentine on a sponge. You see the smoke rising from it, and floating into the air in large quantities, and remember now, the carbonic acid that we have from the candle is from such smoke as that. To make that evident to you I will introduce this turpentine burning on the sponge into a flask where I have plenty of oxygen, the rich part of the atmosphere, and you see that the smoke is all consumed. This is the first part of our experiment, and now what follows? The carbon which you saw flying off from the turpentine flame in the air we have now entirely burned in this oxygen, and we shall find that it will by this rough and temporary experiment, give us exactly the same conclusion and result as we had from the combustion of the candle. The reason why I make the experiment in this manner is solely that I may cause the steps of our demonstration to be so simple that you can never for a moment lose the train of reasoning if you only pay attention. All the carbon which is burned in oxygen, or air, comes out as carbonic acid, whilst those particles which are not so burned show you the second substance in the carbonic acid, namely the carbon, that body which made the flame so bright whilst there was plenty of air, but which was thrown off in excess when there was not oxygen enough to burn it.

I have also to show you a little more distinctly the history of carbon and oxygen in their union to make carbonic acid. You have now a right to know this to a far greater extent than before, so I have

three or four experiments for that purpose. I have here a jar filled with oxygen, and here is some carbon which has been placed in a crucible for the purpose of being made red hot. I keep my jar dry and venture to give you a result imperfect in some degree, in order that I may make the experiment brighter. I am about to put the oxygen and the carbon together. That this is carbon (common charcoal pulverised) you will see by the way in which it burns in the air [letting some of the red hot charcoal fall out of the crucible]. I am now about to burn it in oxygen gas, and look at the difference. It may appear to you at a distance as if it were burning with a flame ; but it is not so. Every little piece of charcoal is burning as a-spark, and whilst it so burns it is producing carbonic acid. I specially want these two or three experiments to point out what I shall dwell upon more distinctly by-and-by—that carbon burns in this way, and not as a flame.

Instead of taking many particles of carbon to burn I will take a rather large piece, which will enable you to see the form and size, and to trace the effects very decidedly. Here is the jar of oxygen, and here is the piece of charcoal, to which I have fastened a little piece of wood, which I can set fire to and so carry on the combustion, which I could not conveniently do without. You now see the charcoal burning, but not as a flame (or if there be a flame it is the smallest possible one, which I know the cause of, namely, the formation of a little carbonic oxide close upon the surface of the carbon). It goes on burning, you see, slowly producing carbonic acid by the union of this carbon or charcoal (they are equivalent terms) with the oxygen. I have here another piece of charcoal, a piece of bark, which has the quality of being blown to pieces—exploding—as it burns. By the effect of the heat we shall reduce the lump of carbon into particles that will fly off; still every particle, equally with the whole mass, burns in this peculiar way—it burns as a coal, and not like a flame. You observe a multitude of little combustions going on, but no flame. I do not know a finer experiment than this to show that carbon burns with a spark.

Here, then, is carbonic acid formed from its elements. It is produced at once, and if we examined it by lime water, you will see that we have the same substance which I have previously described to you. By putting together 6 parts of carbon by weight (whether it comes from the flame of a candle or from powdered charcoal) and 16 parts of oxygen by weight we have 22 parts of carbonic acid ; and, as we saw last time, the 22 parts of carbonic acid combined with 28 parts of lime, produce common carbonate of lime. If you were to examine an oyster-shell and weigh the component parts, you would find that every 50 parts would give 6 of carbon and 16 of oxygen combined with 28 of lime. However, I do not want to trouble you with these minutiæ ; it is only the general philosophy of the matter that we can now go into. See how finely the carbon is dissolving away [pointing to the lump of charcoal burning quietly in the jar of oxygen]. You may say that the charcoal is actually dissolving in the air round about, and if that were perfectly pure charcoal, which we can easily prepare, there would be no residue whatever. When we have a perfectly cleansed and purified piece of carbon there is no ash left. The carbon burns as a solid dense body, that heat alone cannot change as to its solidity, and yet it passes away into vapour that never condenses into solid or liquid under ordinary circumstances ; and what is more curious still is the fact that the oxygen does not change in its bulk by the solution of the carbon in it. Just as the bulk is at first, so it is at last, only it has become carbonic acid.

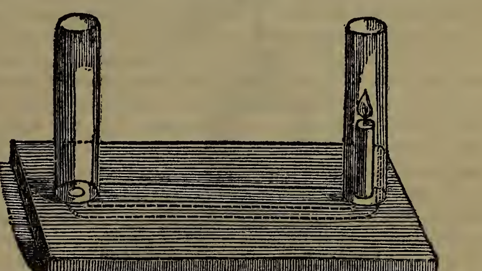
There is another experiment which I must give you before you are fully acquainted with the general nature of carbonic acid. Being a compound body, consisting of carbon and oxygen, carbonic acid is a body that we ought to be able to take asunder. And so we can. As we did with water so we can with carbonic acid,—Take the two parts asunder. The simplest and quickest way is to act upon the carbonic acid by a substance that can attract the oxygen from it, and leave the carbon behind. You recollect that I took potassium and put it upon water or ice, and you saw that it could take the oxygen from the hydrogen. Now, suppose we do something of the same kind here with this carbonic acid. You know carbonic acid to be a heavy gas: I will not test it with lime-water, as that will interfere with our subsequent experiments, but I think the heaviness of the gas and the power of extinguishing flame will be sufficient for our purpose. I introduce a flame into the gas, and you will see whether it will put it out. You see the light is extinguished. Indeed, the gas may, perhaps, put out phosphorus, which you know has a pretty strong combustion. Here is a piece of phosphorus heated to a high degree. I introduce it into the gas, and you observe the light is put out, but it will take fire again in the air, because there it re-enters into combustion. Now let me take a piece of potassium, a substance which even at common temperatures can act upon carbonic acid, though not sufficiently for our present purpose, because it soon gets covered with a protecting coat ; but if we warm it up to the burning point in air, as we have a fair right to do, and as we have done with phosphorus, you will see that it can burn in carbonic acid, and if it burns it will burn by taking oxygen, so that you will see what is left behind. I am going, then, to burn this potassium in the carbonic acid as a proof of the existence of oxygen in the carbonic acid. [In the preliminary process of heating the potassium exploded]. Sometimes we get an awkward piece of potassium that explodes, or something like it, when it burns. I will take another piece, and now that it is heated I introduce it into the jar, and you perceive that it burns in the carbonic acid—not so well as in the air, because the carbonic acid contains the oxygen combined, but it does burn, and takes away the oxygen. If I now put this potassium into water I find that besides the potash formed (which you need not trouble about) there is a quantity of carbon produced. I have here made the experiment in a very rough way, but I assure you that if I were to make it carefully, devoting a day to it, instead of five minutes, we should get all the proper amount of charcoal left in the spoon, or in the place where the potassium was burned, so that there could be no doubt as to the result. Here, then, is the carbon obtained from the carbonic acid, as a common black substance ; so that you have the entire proof of the nature of carbonic acid as consisting of carbon and oxygen. So now, I may tell you, that whenever carbon burns under common circumstances it produces carbonic acid.

Suppose I take this piece of wood, and put it into a bottle with lime-water. I might shake that lime water up with wood and the atmosphere as long as I pleased, it would still remain clear as you see it ;

but suppose I burn the piece of wood in the air of that bottle. You, of course, know I get water. Do I get carbonic acid? [The experiment was performed.] There it is you see, that is to say, the carbonate of lime, which results from carbonic acid, and that carbonic acid must be formed from the carbon which comes from the wood, from the candle or any other thing. Indeed, you have yourselves frequently tried a very pretty experiment, by which you may see the carbon in wood. If you take a piece of wood, and partly burn it, and then blow it out, you have carbon left. There are things that do not show carbon in this way. A candle does not so show it, but it contains carbon. Here also is a jar of coal gas, which produces carbonic acid abundantly,—you do not see the carbon, but we can soon show it to you. I will light it, and as long as there is any gas in this cylinder it will go on burning. You see no carbon, but you see a flame, and because that is bright it will lead you to guess that there is carbon in the flame. But I will show it to you by another process. I have some of the gas in another vessel, mixed with a body that will burn the hydrogen of the gas, but will not burn the carbon. I will light them with a burning taper, and you perceive the hydrogen is consumed, but not the carbon, which is left behind as a dense black smoke. I hope that by these three or four experiments you will learn to see when carbon is present, and understand what are the products of combustion, when gas or other bodies are thoroughly burned in the air.

Before we leave the subject of carbon, let us make a few experiments and remarks upon its wonderful condition, as respects ordinary combustion. I have shown you that the carbon in burning burns only as a solid body, and yet you perceive that after it is burned, it ceases to be a solid. There are very few fuels that act like this. It is in fact only that great source of fuel, the carbonaccous series, the coals, charcoals, and woods, that can do it. I do not know that there is any other elementary substance besides carbon that burns with these conditions, and if it had not been so, what would happen to us? Suppose all fuel had been like iron which, when it burns, burns into a solid substance. We could not then have such a combustion as you have in this fire place. Here also is another kind of fuel which burns very well—as well as, if not better, than carbon—so well, indeed, as to take fire of itself when it is in the air, as you see. [Breaking a tube full of lead pyrophorus.] This substance is lead, and you see how wonderfully combustible it is. It is very much divided, and is like a heap of coals in the fire-place: the air can get to its surface and inside, and so it burns. But why does it not burn in that way now when it is lying in a mass? [Emptying the contents of the tube in a heap on to a plate of iron.] Simply because the air cannot get to it. Though it can produce a great heat, the great heat which we want in our furnaces and under our boilers, still that which is produced cannot get away from the portion which remains unburned underneath, and that portion, therefore, is prevented from coming in contact with the atmosphere, and cannot be consuned. How different is that from carbon! Carbon burns just in the same way as this lead does, and so gives an intense fire in the furnace, or wherever you choose to burn it; but then the body produced by its combustion passes away, and the remaining carbon is left clear. I showed you how carbon went on dissolving in the oxygen, leaving no ash; whereas, here [pointing to the heap of pyrophorus] we have actually more ash than fuel, for it is heavier by the amount of the oxygen which has united with it. Thus, you see, the difference between carbon and lead or iron, if we chose iron, which gives so wonderful a result in our applications of this fuel, either as light or heat. If when the carbon burnt here the product went off as solid body you would have had the room filled with an opaque substance, as in the case of the phosphorus; but when carbon burns everything passes up into the atmosphere. It is in a fixed, almost unchangeable condition before the combustion; but afterwards it is in the form of gas, which it is very difficult (though we have succeeded) to produce in a solid or liquid state.

Now I must take you to a most interesting part of our subject—to the relation between the combustion of a candle and that living kind of combustion which goes on within us. In every one of us there is a living kind of combustion going on exactly like that of a candle, and I must try to make that plain to you. For that is not merely true in a poetical sense—the relation of the life of man to a taper, and if you will follow, I think I can make this clear. In order to make the relation very plain, I have devised a little apparatus which we can soon build up before you. Here is a board and a groove cut in it, and I can close the groove cut in it, and I can close the groove at the top part by a little cover; I can then continue the groove as a channel by a glass tube at



each end, there being a free passage through the whole. Suppose I take a taper or candle (we can now be liberal in the use of the word "candle," since we understand what it means), and place it in one of the tubes; it will go on, you see, burning very well. You observe that the air which feeds the flame passes down the tube at one end, then goes along the horizontal tube, and ascends the tube at the other end in which the taper is placed. If I stop the aperture through which the air enters, I stop combustion, as you perceive. I stop the supply of air, and consequently the candle goes out. But now what will you think of this fact? In a former experiment I showed you the air going from one burning candle to a second candle. If I took the air proceeding from another candle, and sent it down by a complicated arrangement into this tube, I should put this burning candle out. But what will you say when I tell you that my breath will put out that candle? I do not mean by blowing at all, but simply that the nature of my breath is such that a candle cannot burn in it. I will now hold my mouth over the aperture, and without blowing the flame in any way, let no air enter the tube but what comes from my mouth. You see the result. I did not blow the candle out. I merely let the air which I expired pass into the aperture, and the result was that the light went out for want of oxygen, and for no other

reason. Something or other —namely, my lungs—had taken away the oxygen from the air, and there was no more to supply the combustion of the candle. It is, I think very pretty to see the time it takes before the bad air which I throw into this part of the apparatus has reached the candle. The candle at first goes on burning, but so soon as the air has had time to reach it it goes out. And now I will show you another experiment, because this is an important part of our philosophy. Here is a jar which contains fresh air, as you can see by the circumstance of a candle or gas-light burning in it. I make it close for a little time, and by means of a pipe I get my mouth over it so that I can inhale the air. By putting it over water in the way that you see, I am able to draw up this air, (supposing the cork to be quite tight), take it into my lungs, and throw it back into the jar: we can then examine it, and see the result. You observe, I first take up the air, and then throw it back, as is evident from the ascent and descent of the water, and now, by putting a taper into the air, you will see the state in which it is by the light being extinguished. Even one inspiration, you see, has completely spoiled this air, so that it is no use my trying to breath it a second

time. Now you understand the ground of the impropriety of many of the arrangements among the houses of the poorer classes, by which the air is breathed over and over again, for the want of a supply, by means of proper ventilation, sufficient to produce a good result. You see how bad the air becomes by a single breathing, so that you can easily understand how essential fresh air is to us.

To pursue this a little further, let us see what will happen with lime water. Here is a globe which contains a little lime-water, and it is so arranged as

regards the pipes, as to give access to the air within, so that we can ascertain the effect of respired, or unrespired air upon it. Of course I can either draw in air (through A) and so make the air that feeds my lungs go through the lime-water, or I can force the air out of my lungs through the tube (B) which goes to the bottom, and so show its effect upon the lime-water. You will observe that however long I draw the external air into the lime-water, and then through it to my lungs, I shall produce no effect upon the water—I will not make the lime-water turbid; but if I throw the air *from* my lungs through the lime-water, several times in succession, you see how white and milky the water is getting, showing the effect which expired air has had upon it; and now you begin to know that the atmosphere which we have spoiled by respiration is spoiled by carbonic acid, for you see it here in contact with the lime water

I have here two bottles, one containing lime-water and the other common water and tubes which pass into the bottles and connect them. The apparatus is very rough, but it is useful notwithstanding. If I take these two bottles, inhaling here and exhaling there, the arrangement of the tubes will prevent the air going backwards. The air coming in, will go to my mouth and lungs, and in going out, will pass through the lime water, so that I can go on breathing and making an experiment, very refined in its nature, and very good in its results. You will observe that the good air has done nothing to the lime water; in the other case nothing has come to the lime-water, but my respiration, and you see the difference in the two cases.

Let us now go a little further. What is all this process going on within us which we cannot do without, either day or night, which is so provided for by the Author of all things, that He has arranged

that it shall be independent of all will? If we restrain our respiration, as we can to a certain extent, we should destroy ourselves. When we are asleep, the organs of respiration and the parts that are associated with them, still go on with their action so necessary is this process of respiration to us, this contact of the air with the lungs. I must tell you in the briefest possible manner, what this process is. We consume food: the food goes through that strange set of vessels and organs within us and is brought into various parts of the system, into the digestive parts especially; and alternately the portion which is so changed, is carried through our lungs by one

set of vessels, while the air which we inhale and exhale, is drawn into and thrown out of the lungs by another set of vessels, so that the air and the food come close together, separated only by an exceedingly thin surface: the air can thus act upon the the blood by this process, producing precisely the same result in kind as we have seen in the case of the candlè. The candle combines with parts of the air, forming carbonic acid, and evolves heat; so in the lungs there is this curious, wonderful change taking place. The air entering, combines with the carbon (not carbon in a free state, but, as in this case, placed ready for action at the moment), and makes carbonic acid, and is so thrown out into the atmosphere, and thus this singular result takes place; we may thus look upon the food as fuel. Let me take that piece of sugar, which will serve my purpose. It is a compound of carbon, hydrogen, and oxygen, similar to a candle, as containing the same elements, though not in the same proportion; the proportions being as shown in this table:—

Sugar

Carbon	72	
Hydrogen	11	99
Oxygen	88	

This is, indeed, a most curious thing, which you can well remember, for the oxygen and hydrogen are in exactly the proportions which form water, so that sugar is compounded of 72 parts of carbon and 99 parts of water; and it is the carbon in the sugar that combines with the oxygen carried in by the air in the process of respiration, so making us like candles; producing these actions, warmth, and far more wonderful results besides, for the sustenance of the system, by a most beautiful and simple process. To make this still more striking, I will take a little sugar, or to make the experiment shorter I will use some syrup, which contains about three-fourths of sugar and a little water. If I put a little oil of vitriol on it it takes away the water, and leaves the carbon in a black mass. [The Lecturer mixed the two together.] You see how the carbon is coming out, and before long we shall have a solid mass of charcoal, all of which has come out of sugar. Sugar, as you know, is food, and here we have absolutely a solid lump of carbon where you would not have expected it. And if I make arrangements so as to oxidise the carbon of sugar, we shall have a much more striking result. Here is sugar, and I have here an oxidiser—a quicker one than the atmosphere; and so we shall oxidise this fuel by a process different from respiration in its form, though not different in its kind. It is the combustion of the carbon by the contact of oxygen which the body has supplied to it. If I set this into action at once you will see combustion produced. Just what takes place in my lungs—taking in oxygen from another source, namely, the atmosphere, takes place here by a more rapid process.

You will be astonished when I tell you what this curious play of carbon amounts to. A candle will burn some four or five, or six, or seven hours. What then must be the daily amount of carbon going up into the air in the way of carbonic acid! What a quantity of carbon must go from each of us in respiration! What a wonderful change of carbon must take place under these circumstances of combustion or respiration! A man in twenty four hours converts as much as seven ounces of carbon into carbonic acid; a milch cow will convert seventy ounces, and a horse seventy-nine ounces, solely by the act of respiration. That is, the horsê in twenty four hours burns seventy-nine ounces of charcoal, or carbon, in his organs of respiration to supply his natural warmth in that time. All the warm-blooded animals get their warmth in this way, by the conversion of carbon, not in a free state, but in a state of combination. And what an extraordinary notion this gives us of the alterations going on in our atmosphere. As much as 5,000,000 pounds, or 548 tons, of carbonic acid is formed by respiration in London alone in twenty-four hours. And where does all this go? Up into the air. If the carbon had been like the lead which I showed you, or the iron which, in burning, produces a solid substance, what would happen? Combustion could not go on. As charcoal burns it becomes a vapour and passes off into the atmosphere, which is the great vehicle, the great carrier for conveying it away to other places. Then what becomes of it? Wonderful is it to find that the change produced by respiration, which seems so injurious to us (for we cannot breathe air twice over) is the very life and support of plants and vegetables that grow upon the surface of the earth. It is the same also under the surface, in the great bodies of water, for fishes and other animals respire upon the same principle, though not exactly by contact with the open air. Such fish as I have here [pointing to a globe of gold-fish] respire by the oxygen in the air, which is dissolved by the water, and form carbonic acid, and they all move about to produce the one great work of making the animal and vegetable kingdoms subservient to each other. And all the plants growing upon the surface of the earth, like that which I have brought here to serve as an illustration, absorb carbon: these leaves are taking up their carbon from the atmosphere to which we have given it in the form of carbonic acid, and they are growing and prospering. Give them a pure air like ours, and they could not live in it; give them carbon with other matters, and they live and rejoice. This piece of wood gets all its carbon, as the trees and plants get theirs, from the atmosphere, which, as we have seen, carries away what is bad for us and at the same time good for them,—what is disease to the one being health to the other. So are we made dependent not merely upon our fellow-creatures but upon our fellow-existers, all nature being tied together by the laws that make one part conduce to the good of another.

There is another little point which I must mention before we draw to a close—a point which concerns the whole of these operations, and most curious and beautiful it is to see it clustering upon and associated with the bodies that concern us—oxygen, hydrogen, and carbon, in different states of their existence. I showed you just now some powdered lead, which I set burning; and you saw that the moment the fuel was brought to the air it acted, even before it got out of the bottle,—the moment the air crept in it acted. Now, there is a case of chemical affinity by which all our operations proceed. When we breathe the same operation is going on within us. When we burn a candle the attraction of the different parts one to the other is going on. Here it is going on in this case of the lead, and it is a beautiful instance of chemical affinity. If the products of combustion rose off from the surface, the lead would take fire, and go on burning to the end; but, you remember, that we have this difference between charcoal and lead—that, while the lead can start into action at once if there be access of air to it, the carbon will

remain days, weeks, months, or years. The manuscripts of Herculaneum were written with carbonaceous ink, and there they have been for 1800 years or more, not having been at all changed by the atmosphere, though coming under various circumstances in contact with it. Now, what is is the circumstance which makes the lead and carbon differ in this respect? It is a striking thing to see that the matter which is appointed to serve the purpose of fuel *waits* in its action; it does not start off burning, like the lead and many other things that I could show you, but which I have not encumbered the table with; but it waits for action. This waiting is a curious and wonderful thing. Candles—those Japanese candles, for instance—do not start into action at once like the lead or iron (for iron finely divided does the same thing as lead), but there they wait for years, perhaps for ages, without undergoing any alteration. I have here a supply of coal-gas. The jet is giving forth the gas, but you see it does not take fire—it comes out into the air, but it waits till it is hot enough before it burns. If I make it hot enough it takes fire. If I blow it out the gas that is issuing forth waits till the light is applied to it again. It is curious to see how different substances wait—how some will wait till the temperature is raised a little, and others till it is raised a good deal. I have here a little gunpowder and some gun-cotton; even these differ in the conditions under whcih they will burn. The gunpowder is composed of carbon and other substances, making it highly combustible; and the gun-cotton is another combustible preparation. They are both waiting, but they will start into activity at different degrees of heat, or under different conditions. By applying a heated wire to them we shall see which will start first [touching the gun-cotton with the hot iron]. You see the gun cotton has gone off, but not even the hottest part of the wire is now hot enough to fire the gunpowder. How beautifully that shows you the difference in the degree in which bodies act in this way. In the one case the substance will wait any time until the associated bodies are made active by heat; but, in the other, as in the process of respiration, it waits no time. In the lungs, as soon as the air enters, it unites with the carbon, even in the lowest temperature which the body can bear short of being frozen, the action begins at once, producing the carbonic acid of respiration; and so all things go on fitly and properly. Thus you see the analogy between respiration and combustion is rendered still more beautiful and striking. Indeed, all I can say to you at the end of these Lectures (for we must come to an end at one time or other) is to express a wish that you may, in your generation, be fit to compare to a candle; that you may, like it, shine as lights to those about you; that, in all your actions, you may justify the beauty of the taper by making your deeds honourable and effectual in the discharge of your duty to your fellow-men.

NITROGENOUS, NUTRITIOUS, OR FLESH-FORMING SUBSTANCES USED AS FOOD.

In the tissues of all plants a substance is found which was known to chemists under the names of gluten, legumin, diastase, zymome, &c. These substances were found by Mulder to yield, by the action of potash and acetic acid, a precipitate, which he called protein, and which he also obtained from the animal substances knows as albumen, fibrine, caseine, &c. By this discovery it was demonstrated that the source of the substances forming the flesh of animals is the protein of plants. Whether it occurs in animals or plants, it may be divided for practical purposes into three forms—albumen, fibrine, and caseine.

Albumen is found in plants, in the juice of cabbages, asparagus, chesnuts, wheat, rye, &c.; in animals, in the blood, nerves, and the white of eggs.

Fibrine is found in plants, in wheat, barley, oats, rye, &c.; in animals, in their muscular tissue or flesh.

Caseine is found in plants, in peas, beans, lentils, and the seeds of all *Leguminosæ*; in animals, almost exclusively in the milk of the mammalia.

Flesh-formers in Food.

All the organs of the body contain the four elements, *Carbon, Hydrogen, Nitrogen,* and *Oxygen:* and no ingredients of food can be of use in building up the wasted parts of the body unless these four elements are present. The nutritive or flesh-forming parts of food are Fibrin, Albumen, and Casein: they contain the four elements in exactly the same proportions, and are found both in vegetable and in animal food. Fibrin may be got either by stirring fresh-drawn blood, or from the juice of a cauliflower; Albumen or white of egg from eggs, from cabbage juice, or from flour. Casein or Cheese exists more abundantly in peas and beans than it does in milk itself. Fibrin, Albumen, and Casein, whether they are got from vegetable or animal bodies, have the same composition as dried flesh and blood. The growth and support of an animal is now easily explained: when a flesh-eater, like the tiger, lives on the flesh of another animal, it eats, in a chemical point of view, the substance of its own body, and requires only to give it a new place and form. When a child receives its mother's milk, it does the same thing, eating in fact its mother, and giving her flesh a new place and form in its own body. The nutrition of vegetable feeders is precisely the same: they find in Vegetable Fibrin, Albumen, and Casein the substance of their flesh and blood actually formed, and have only to give it a place and position within their bodies. Vegetables are the true makers of flesh: animals only arrange the flesh which they find ready formed in vegetables. The *nutritive* value of food depends upon its richness in flesh-forming matter. An adult man, in vigor, wastes five ounces of dry flesh daily, and requires the same amount of flesh formers in his food.

The bodies which form the basis of flesh, or any other organized part, are included under the popular name of "Flesh-formers;" although in reality, besides these, water, fat, and mineral matter are found in flesh, and are, in one sense, necessary to its formation. A piece of clean muscular fibre, or dry blood, free from water, fat, and mineral matter, has the same composition as either Albumen, Fibrin, or Casein, whether they are obtained from substances of Vegetable or Animal origin. 100 parts contain:—

Carbon	54.0
Hydrogen	7.0
Nitrogen	15.5
Oxygen	23.5

1. Albumen, made from eggs and from blood. It forms about 7 parts in 100 of blood, and is always

present in lymph and chyle. Liquid or soluble albumen, as shown in the white of egg, coagulates by heat and various chemical agents.

2. Albumen, as found in the juice of carrots, turnips, and cabbages, and obtained by boiling their juices. It is the same body as albumen from eggs.

3. Fibrin made by stirring blood with a rod. It is the basis of muscle of flesh. Flesh-fibrin probably bears the same relation to blood-fibrin as coagulated albumen does to soluble albumen.

4. Fibrin made from Wheat-flour. It is identical with the fibrin found in flesh, but not exactly the same as that found in blood, and is known as *Gluten.*

5. Casein prepared from milk, in which it is soluble, owing probably to a little alkali: when an acid is added, the Casein curdles or coagulates, and then is known as Cheese. In 100 parts of cows' milk there are 3½ parts of Casein.

6. Casein or Legumin, as found in peas, beans, lentils, coffee, &c. The Casein of Vegetables is now supposed by most chemists to be identical with the Casein or Cheese of Milk, but a few chemists still deny this. 100 parts of peas contain above 20 parts of Casein.

The flesh formers are most abundant in those plants which yield the substantive food of man. These plants belong principally to the group of Cereal grasses and Leguminous plants. Of these the most important is Wheat.

WHEAT, (Species? of the genus *Triticum*)

The plants yielding Wheat belong to the natural order of Grasses (*Graminaceæ*). They have never been found in a perfectly wild state, and on that account have been supposed to originate in some other form of Grass at present wild. Although surmises have been made that the wheats originate in a wild plant called *Ægilops ovata*, the fact of the conversion of one into the other has not yet been proved. The Wheat plant is grown all over the world, but flourishes mostly between the parallels of 25 and 60 degrees of latitude. It is more abundant in the northern than in the southern hemisphere.

The varieties of Wheat cultivated in Europe may be divided into those whose flowers produce awns, and those without these appendages, or *bearded* and *beardless* Wheats. The fruits or seeds of these varieties are red or white, hence a further sub-division takes place into *red* or *white*, bearded or beardless, Wheats. Amongst the red bearded varieties is the fingered Egyptian or Mummy Wheat, which presents the peculiarity of several branches bearing fruits proceeding from its central stalk. Wheat is also called hard and soft according to its consistence, and winter and spring as it is sown at those seasons of the year. The red varieties yield the largest amount of grain, but the white the whitest flour.

Wheat is preferred to the other Cereal grasses as an article of food on account of its containing a larger quantity of flesh-forming matters. The flour also may be rendered very white by separating it from the husks, or bran, and the fruit is much more easily separated from the chaff than is the case with the other Cereals. The proportion of flesh-forming matters to those which give heat are more nearly adjusted to the requirements of the system in Wheat than in any other food. Hence, probably, its very general use as an article of food amongst the populations of the hardest working nations in the world.

The quantity of Wheat-corn grown annually in the United Kingdom has been calculated at 14,000,000 of quarters. In 1858, 3,000,000 of quarters of Wheat were imported into this country, exclusive of flour, meal, sago, rice and other grain.

Good Wheat should give three-fourths of its weight of fine flour; but the chemical composition of this depends upon the greater or less quantity which it contains of the outer husks. The finest flour is not so rich in flesh forming matter as the coarser kinds. The average composition in 100 parts may be taken as:—

Water	14·0	or	Water	14·0
Gluten	12 8		Flesh-formers	14·6
Albumen	1·8		Heat-givers	69·8
Starch	59·7		Mineral Matter	1·6
Sugar	5.5			
Gum	1.7			
Fat	1·2			
Fibrine	1·7			
Ashes	1·6			

1. Wheat, of which the chemical composition varies according to the varieties, 21 oz. required to make 1 lb. of flour.

2. Bran, or outer and inner skins of the wheat—5¼ oz.

3. Flour, or the inner part of wheat separated from the outer parts of bran—16 oz.
4. Water from 1 lb. of Flour—2¼
5. Gluten from 1 lb. of flour—2 oz.
6. Albumen from 1 lb. of flour—¼ oz.
7. Starch from 1 lb. of flour—9½ oz.
8. Sugar from 1 lb. of flour—1 oz.
9. Gum from 1 lb. of flour—¼ oz.
10. Fat from 1 lb. of flour—⅛ oz.
11. Fibre from 1 lb. of flour—¼ oz.
12. Ashes from 1 lb. of flour—¼
13. *Carbon from* 1 lb. *of flour*—7 *oz.*

BREAD.

All food is called bread which is made from the flour of grains or seeds made into dough and baked. Bread is either *vesiculated* or *unvesiculated.* The latter is called unleavened bread, and consists of such preparations of flour as are known by the name of biscuits and cakes.

Vesiculated bread is prepared in two ways, either by *fermentation* or *aëration.* In all cases fermented bread is made from the flour of wheat, or a mixture of this with the meal or flour of other grain. Oats, barley, maize, rye, will not alone make fermented bread. The meal of these grains is added to wheaten flour when they are made into bread.

In the making of fermented bread yeast is added to the flour, and the gluten of the flour is put into a state of change, but not decomposed. A small portion of the starch is formed into glucose, which is decomposed, and alcohol formed, and carbonic acid produced. The carbonic acid gas escaping from the mass vesiculates the bread. This process is called the *rising* of the bread. It is in this stage that the starch enters into a state of change which assists its subsequent solution in the stomach.

Bread is vesiculated, without being fermented, by two processes. 1, by the addition of substances which during their decomposition give out carbonic acid, as carbonate of soda and hydrochloric acid. 2, by making the bread with water charged with carbonic acid gas. The first is the process recommended by Dr. Whiting, and sold in London under the name of Dodson's Unfermented Bread. The second process consists in mixing water, containing carbonic acid gas under pressure, with flour, so that

when the dough is baked the escape of the carbonic acid gas vesiculates the bread. This process is worked in London under Dr. Dauglish's patent, and extensive machinery for making this bread has been erected by Messrs. Peak, Frean & Co., Dockhead. It is called Aërated Bread.

Both forms of vesiculated bread are adapted for general use. In certain morbid conditions of the stomach fermented bread undergoes changes which are productive of inconvenience, and which is prevented by unfermented bread.

Barley, (*Hordeum distichum.*)

Next in importance to Wheat amongst the cultivated grains of this country is Barley.

The barley-plant, like wheat and oats, belongs to the natural order of grasses (*Graminaceæ*). Although there are several species of the genus *Hordeum*, to which barley belongs, it is probable that all the varieties cultivated belong to the species *Hordeum distichum*. This plant appears to be a native of Asia, but it has a remarkable power of adapting itself to a great range of temperature, and it has a wider distribution than either wheat or oats. On the eastern continent its culture extends from 70° north latitude to 42° south, whilst in America its culture reaches as far as 20° to 62° north latitude.

Its use as an article of food is coeval with the history of man, and we learn from the Sacred Writings that it was cultivated and used as food by the Israelites from the earliest period of their history.

The grain of the barley is used in this and other countries of the world for two purposes ; first for food, and second for making beer and distilled spirits. As a food barley is less rich in starch and nutritive matters than wheat. It contains a large quantity of ashes, and its meal makes agreeable cakes, which at one time were consumed largely as food by the population of Great Britain, Barley cakes are still eaten in Yorkshire ; and the barley, deprived of its husks, is used in cookery under the name of "pearl barley."

The great consumption of barley in this country is in the making of malt. In this process the barley is allowed to germinate ; the starch of the seed is changed into sugar, which is subsequently converted into alcohol by fermentation in the manufacture of beer. In this way upwards of 5,000,000 of quarters are annually consumed in Great Britain.

Barley yields a greater produce per acre than any other grain except rice. The counties in England in which it is chiefly cultivated are Norfolk, Suffolk, Cambridge, Bedford, Herts, Leicester, and Nottingham. In Spain, Sicily, the Canaries, Azores, and Madeira, two crops are produced in the year.

In chemical composition, Barley and Wheat are much alike ; but Barley does not form such a fine and spongy bread as Wheat, although it is equally nutritive : 100 parts contain :—

Water	14·0	or	Water	14·0	
Gluten	12·8		Flesh-formers	13·0	Carbon 40·0
Starch	48·0		Heat-givers	69.5	
Sugar	3·8		Mineral Matter	3·5	
Gum	3·7				
Fat	0·3				
Fibre	13·2				
Ashes	4·2				

The Case shows the quantities of these ingredients found in 1 lb. of Barley.

1. Barley containing 14 parts of water—1 lb.
1. *a*. Pot Barley got from 1 lb. of Barley—11¼ oz.
2. Water obtained from 1 lb. of barley—2⅓ oz.
3. Gluten obtained from 1 lb. of barley—2¼ oz.
4. Starch obtained from 1 lb. of barley—7½ oz.
5. Sugar obtained from 1 lb. of barley—½ oz.
6. Gum obtained from 1 lb. of barley—⅓ oz.
7. Fat obtained from 1 lb. of barley—$\frac{1}{16}$ oz.
8. Fibre obtained from 1 lb. of barley—2⅓
9. Ashes obtained from 1 lb. of barley—½ oz.
10. *Carbon in 1 lb. of barley—6½ oz*

Barley Meal was formerly much used in England for making barley cakes, and at the present day barley flour is found to be a useful, nutritious food for children, on account of its laxative action.

Oats.

The Oat is largely consumed in Great Britain as food. Its preparations and analyses are exhibited with the following label:—

The most commonly cultivated species of Oat is the *Avena sativa*, a plant belonging to the natural order of grasses (*Graminaceæ*). Other species of oats are known by the names of *Avena nuda*, the naked Oat pilcorn, or peelcorn ; *Avena orientalis*, the Tartarian Oat ; *Avena brevis*, the short Oat ; and *Avena strigosa*, the bristle-pointed Oat. Only the two last are found wild ; and some writers suppose that all forms of oat have taken their origin in the last, which is found wild abundantly in corn-fields all over Europe.

The oat is a much harder plant than either wheat or barley, and ripens its fruit in higher northern latitudes. An insular climate is adapted to its growth, hence it has been extensively cultivated in the British Islands, more particularly Scotland where the best oats are grown.

The oat, like other cereal grains, is well adapted for human food, as it contains the mineral, flesh forming and heat-giving constituents, which are essential to food. The following comparison by Johnston of the composition of the oat with wheat and maize will show the relative quantities of the most important constituents of these plants.

		Wheat Flour.	Bran.	Oat meal.	Indian Corn Meal.
Water		16	13	14	14
Flesh-formers		20	18	18	12
Heat-givers	Starch	2	6	6	8
	Fat	62	63	62	66
		100	100	100	100

Oatmeal is not so digestible as wheaten flour or wheaten meal, hence persons whose occupations are sedentary prefer the latter ; but for those who work or take exercise in the open air, oatmeal is a more economical and strengthening diet than wheaten flour. Oatmeal cannot be made into bread, and is usually eaten in the form of a cake or oatmeal porridge. The latter is usually eaten with milk, and is then a very nourishing and healthful article of diet.

Nearly twice as much oats as wheat is raised in the United Kingdom, but comparatively small quantities are imported. Their large consumption depends on their being used as the principal food for horses.

Oats, in the form of Oatmeal, are rich in flesh-formers and heat-givers, and serve as a nutritious

and excellent diet, when the occupation is not sedentary. The outer husks of Oats, unlike Wheat, are poor in flesh-formers, so that oatmeal is better than the whole oat as food, In making oatmeal, one quarter of oats (328 lbs.) yields 188 lbs. of meal and 74 lbs. of husks ; the rest being water. Oatmeal is remarkable for its large amount of fat. 100 parts contain :—

Water	13·6
Flesh-formers	17·0
Starch	39·7
Sugar	5·4
Gum	3·0
Fat	5·7
Fibre	12·6
Mineral Matter	3·0

or

Water	13·6	
Flesh-formers	17.0	Carbon 43.0
Heat-givers	66.4	
Mineral Matter	3·0	

1. Shows 1 lb. of Oats with the usual husk.
2. 1 lb. of oatmeal of which about 57 per cent is obtained from oats.
3. Water in 1 lb. of oatmeal—2⅛ oz.
4. Flesh-formers in 1 lb. of oatmeal—2¾ oz.
5. Starch in 1 lb. of oatmeal—6⅓ oz.
6. Sugar in 1 lb. of oatmeal—⅞ oz.
7. Gum in 1 lb. of oatmeal—½ oz.
8. Fat or oil in 1 lb. of oatmeal—⅞ oz.
9. Fibre in 1 lb of oatmeal—2 oz.
10. Ashes in 1 lb. of oatmeal—½ oz.
11. *Carbon in 1 lb. of oatmeal*—6⅘

Maize or Indian Corn, (*Zea Mays.*)

This cereal is a native of the New World, where it is extensively cultivated both in the United States and South America.

What Wheat is in Europe, Rice in Asia, Maize is in America. It belongs to the natural order of Grasses (*Graminaceæ*), and is remarkable in this group for the large size of its grains, and the heads into which they are collected. The stem of the Maize grows from five to seven feet in length. The stamens are placed in terminal flowers at the top of the stalk, whilst the fruit-bearing flowers are placed on the side of the stalk.

The Maize is a native of the New World, and grows wild in the neighbourhood of Mexico and the Rocky Mountains. It was not known in other parts of the world till after the discovery of America. It has now been introducd into every quarter of the globe. It is cultivated extensively in the south of Europe, on the African coasts of the Mediterranean, in Turkey, Egypt, Hindostan, China, the Islands of the Eastern Archipelago, and in the West Indies.

Several varieties are cultivated, which differ in the form, and colors of their grains.

Although Maize will grow in the British Islands, it cannot be relied on as a field-crop.

Maize was not much consumed in Great Britain till the year of the potato famine, 1846, when considerable quantities of the grain, and meal of the Maize, called "hominy," were imported. There is now a regular demand, and about 2,000,000 of quarters are imported. Of this the larger quantity comes from the ports of the Black Sea and the Mediterranean.

Maize is an excellent food for man and beast. The meal will not form bread alone, but it may be made into porridge, puddings, cakes, and other forms of diet. Maize contains less flesh forming matter than wheat, but it contains more fat. It is largely used in this country on account of its starch, which is separated and used as an article of diet in place of arrow-root and amylaceous foods.

Maize yields a large return of food on a given extent of land. It contains less flesh-forming matter than other cereals, but is rich in heat-givers, and consequently has remarkable fattening qualities. 100 parts contain :—

Water	14·0
Gluten	12·0
Starch	60·0
Sugar, Gum	0·3
Fat	7.7
Fibre	5·0
Mineral Matter	1.0

or

Water	14·0	
Flesh-formers	12·0	Carbon 36·4
Heat-givers	73·0	
Mineral Matter	1·0	

The case shows the ingredients in 1 lb. of Maize, or Indian Corn.

1. Shows 1 lb. of Maize, or Indian corn.
2. 1 lb. of Indian meal.
3. Water in 1 lb. of Indian meal—2 oz. 105 gr.
4. Gluten in 1 lb. of Indian meal—1 oz. 402 gr.
5. Starch in 1 lb. of Indian meal—9 oz. 263 gr.
6. Sugar and Gum in 1 lb. of Indian meal—21 gr.
7. Fat or oil in 1 lb. of Indian meal—1 oz. 101 gr.
8. Woody fibre in 1 lb. of Indian meal 350 gr.
9. Ashes in 1 lb. of Indian meal—70 gr.
10. *Carbon in 1 lb. of Indian meal—5¾ oz.*

—*Guide to the Food Collection, S. Kensington Museum.*

The Board of Arts & Manufactures

FOR UPPER CANADA.

PROCEEDINGS OF THE BOARD.

Board Room, Mechanics' Institute,
Toronto, July 2nd, 1861.

The Board met at half-past one o'clock, p.m., present:—The President (Dr. Beatty), the Vice-President (Mr. J. E. Pell), and Messrs. W. Hay, T. Sheldrick, Professor Buckland, Rice Lewis and W. Edwards.

The Secretary read the following Report:

The Sub-Committee beg to submit the following report:—

The draft of Bill to amend the Act constituting the Boards of Arts and Manufactures, and the various Agricultural Associations, as adopted by the Board at the last Annual Meeting, and by the Board of Arts and Manufactures for Lower Canada ; and also, with two trifling exceptions, by the Board of Agriculture for Upper Canada, was submitted to the Government during the late session of Parliament.

Your Committee have adopted, as their report thereon, the following portion of the Report of the Lower Canada Board, of the 28th of May :—

"After several interviews with members of the government, by Professor Hind on behalf of the Upper Canada Board, and your Vice-President and Secretary on behalf of this Board, the draft of Bill to amend the Act constituting the Boards of Arts and Manufactures was confided to the Hon. Mr. Ferrier, and by him introduced in the Legislative Council. At the beginning of the session the Board of Agriculture, through Major Campbell, introduced the bill of last session to amend the act constituting that Board, but without the portions relating to the Boards of Arts and Manufactures. In committee, however, the bill relating to this Board was incorporated with it, and further proceedings upon Mr. Ferrier's bill

stayed in the Council. The two bills thus amalgamated passed the Lower House without opposition, and received a second reading in the Council. Having been referred to a committee, however, it was never reported, the committee deeming that the amendments in the constitution of the Board of Agriculture and the abolition of the Provincial Agricultural Association would not be acceptable to the farmers of Upper Canada. The other bill, relating solely to the Boards of Arts and Manufactures, was then moved to a second reading, with the assent of the Government, and referred to a committee, where all but the more important clauses were cut out. In its reduced form it received a third reading, and was sent to the Lower House, where, however, the Agricultural influence revenged itself upon the Upper Canada members of the Council representing the Agricultural interest, who had defeated their bill, by refusing to suspend the rules and allow the bill of the Boards of Arts to become law. They declared that both bills should go through, or neither."

Your Committee remark that in the draft of Bill as submitted by this Board, full provision was made for the permanency and harmonious working of the "Provincial Agricultural Associations." The leaving out this portion of the Bill in the Lower House, was undoubtedly owing to Lower Canadian influence. Your committee strongly urged upon the Government the inexpediency of abolishing the Associations, and were assured that it would not be consented to by the Government.

Your committee were not aware that the Hon. Mr. Ferrier's Bill had been reported by the Committee of the Upper House, and subsequently passed its third reading, and are therefore quite ignorant of its provisions. Your committee united with the Board for Lower Canada in asking for increased grants to the respective Boards, so as to enable them more satisfactorily to prosecute the several objects imposed upon them by their Act of Incorporation ; but owing to the financial position of the Province, the Government did not feel justified in recommending any increase for the current year.

Your Committee approved of the movement made by the Lower Canada Board in preparing a bill, and urging upon the Government the necessity for the changes proposed in the laws regulating the issuing of letters patent for inventions and designs in Canada, especially as the laws of the United States have recently been so far modified as to allow of letters patent being taken out by the subjects of any country, on the same terms as by American citizens ; provided the same privileges are extended to citizens of the United States by the Government of the country of which the applicant is a subject. Your committee cannot but regret that the exertions of the Lower Canada Board have been unsuccessful, as citizens of Canada are now excluded, under any circumstances, from obtaining patent rights in the United States ; it is satisfactory, however, to report that the portion of the bill relating to the registration of trade marks, and designs, was introduced as a separate measure, and became law.

In April last a special committee was appointed, who reported a number of suggestions on the best mode of action to be adopted by this Board, in relation to the International Exhibition of 1862 ; these suggestions contained an outline of a scheme of operations proposed to be carried out, with such modifications as might thereafter be found necessary, in conjunction with a Provincial Commission which your committee then had no doubt would be appointed.

The Board for Lower Canada concurred generally in the report of your committee, but suggested a different classification of some of the objects to be exhibited ; these reports, and the memorials of both Boards praying for the appointment of a Commission, and the appropriation of a sufficient sum of money from the revenue of the Province to ensure the successful carrying out of the objects contemplated, were published in the April and May numbers of the *Journal*; the Government, however, refused to insert in the estimates for the year any appropriation for the purpose, nor has any Commission been appointed to act in conjunction with Her Majesty's Commissioners; in consequence of which the enterprise of private individuals will be effectually checked, as they will not be allowed to exhibit, nor will any communication be held with them, except through the medium of a Provincial Commission.

Your Committee agree with the Committee of the Lower Canada Board, as to the disastrous effect this "unwise economy" will have upon the interests of the Province.

"When the eclat of the visit of the heir apparent is still fresh in the minds of the people of Britain, to put in an apparent admission that we have already culminated and are beginning to decay, that we can not do as well now as we did ten years ago, is to submit to humiliation, to lose ground, and accept defeat in the contest for industrial rank."

Your Committee have to report that no Candidates presented themselves for the Examinations which the Board proposed to hold in May last ; this probably is not to be wondered at considering the short notice given, and the difficulties experienced by Mechanics' Institutes in this country in establishing class instruction amongst their members.

In answer to the advertisement offering two prizes for the first and second best essays on "the Manufactures which are most suited to the circumstances and capabilities of Upper Canada," the Secretary reports that but one essay has been received. Your committee have appointed C. S. Gzowski, Esq., Professor Buckland, and Rev. Professor Lillie, a committee of judges to report on the merits of the essay sent in.

A contribution from Messrs. Maw & Co., of Broseley, Salop, England, has just been received for the museum of building materials of this Board, being four large frames of Encaustic Tiles, examples of

their manufactures, showing the effect of the complete pavement when laid. Framed Patterns, Pattern Books and Price Lists, have also been received.

A considerable number of valuable and expensive works on Architecture, Mechanics and Manufactures, Ornament and Decoration, &c., &c., have been added to the library since last report, and will be open to the public for reference as soon as the fitting up, (now going on) in the Board rooms, in the New Hall of the Mechanics' Institute, is completed. A full catalogue of the books will be published in either the August or September number of the Journal.

The Journal of the Board has now reached its seventh monthly issue, and from the favourable notices of the press, and from other sources, your committee conclude that the expectations of its friends have been in some respects realized; your Committee cannot, however, but express their surprise that of upwards of fifty Mechanics' Institutes in Upper Canada, but twelve have as yet obtained from among their members any subscribers to the Journal, although furnished at the low rate of fifty cents per annum; nor has a single communication been received for its pages from members of any Institute out of Toronto.

Your Committee made satisfactory arrangements with the Board for Lower Canada, whereby their proceedings are regularly published in the Journal; said Board subscribing for 250 copies.

One free copy is sent to each Mechanics' Institute, and to the members of both branches of the Legislature, by the respective Boards.

The Treasurer's balance sheet, herewith submitted, shows total receipts for the past six months, including balance from last year, of $2,621 36; Expenditure, $1,353 26; balance in hand, $1,268 10.

JOHN BEATTY,
President.

Resolved—That the Report be received and adopted.

Resolved—That the Sub-Committee be instructed to memorialize the Governor in Council to appoint a Provincial Commission to act on behalf of contributors to the proposed International Exhibition of 1852.

Resolved—That the Secretary be instructed to advertize the Library and Model Rooms as open to the Public, so soon as the rooms now being fitted up, in the New Hall of the Mechanics' Institute, are ready; also inviting donations to the Museum of the Board of Examples of the Manufactures of the Province, and of such of its natural products as may be made available for Art or Manufacturing purposes.

The meeting then adjourned.

WM. EDWARDS,
Secretary.

MEETING OF THE SUB-COMMITTEE.

The Monthly meeting of the Sub-committee was held on Thursday, July 25th: present—the President and Messrs Dr. Craigie, T. Sheldrick and W. Hay.

After reading the minutes of previous meeting, and transaction of routine business, it was—

Resolved,—That the President and the Secretary be instructed to prepare and forward to his Excellency the Governor General, in Council, a Memorial praying for the appointment of a Provincial Commission, to act on behalf of private contributors to the International Exhibition of 1862.

Resolved,—That the Programme of Examinations of Members of Mechanics' Institutes, issued in December, 1860, (See Journal for January, 1861) be adopted as the Programme of Examinations for 1862; and that Tuesday, Wednesday, Thursday and Friday, the 27th, 28th, 29th and 30th of May be appointed the days for holding such examinations, and at the same hours as specified in the time table for 1861.

Resolved,—That the Secretary be instructed to send to each Mechanics' Institute in U. C. copies of the Programme of Examinations; and to intimate that a sum of ten dollars will be awarded to each Institute establishing, and keeping in operation for three months, a class, of not less than six members, for the study of any of the subjects mentioned in the Programme, and submitting at least two members of said class as candidates for the final examinations by the Board in May next.

Resolved,—That in addition to the certificates awarded to candidates at the final examinations, Silver Medals will be awarded to the most successful candidates, in the proportions of one to every five who shall pass such examinations.

WM. EDWARDS,
Secretary.

LIBRARY AND MODEL ROOMS.

The Library, Model and Board Rooms, have been removed to a commodious suite of Rooms in the New Hall of THE TORONTO MECHANICS' INSTITUTE, situated on the north-east corner of Church and Adelaide streets, and are open to the public free, from 10 a.m. till noon, and from 1 to 4 o'clock, p.m.

The Library contains several hundred volumes of valuable books of Reference in Architecture, Decoration and Ornament, Designing, Encyclopedias, Engineering and Mechanics, Manufactures and Trades, General Science, Patents of Inventions of Great Britain and Canada, &c., &c., &c.

The Model Rôoms contain several hundred models of Patented Canadian Inventions, and the commencement of a Museum of specimens of Foreign and Canadian Manufactures.

The Board respectfully solicits from the manufacturers of Canada, specimens of their various productions, or of any natural products capable of being used in Manufactures.

Specimens of Machinery, or of other bulky articles, are requested to be furnished in model.

EDITORIAL NOTICES.

CANADIAN ROOFING SLATE.

It has always struck us as the height of imprudence in the erection of many a handsome building, where the walls have been built substantially and of materials proof against fire, that the roof should be covered with wood shingles, the most flimsy and dangerous of substances. The effect of a blazing sun upon a roof presenting a right angle to its rays, is to convert the thin chips of wood with which it is covered into a species of tinder, that a single spark would ignite.

Wood, when much heated, evolves a highly inflammable gas. It was observed during the raging of the great fire at St. John's, Newfoundland, when the greater part of the town was destroyed, that the roofs of the houses, although the whole of the buildings were of wood, were always first ignited, and by this means the fire spread with amazing rapidity. A single spark, in many instances, was observed to kindle a roof as if it had been thatched with touchwood.

It is thought that a thin coating of mortar under the shingles is sufficiently fire-proof, but this is often delusive. The mortar, however well prepared, after a few years becomes pulverized from the vibration of the roof, and is thus rendered useless.

The cost of a slate roof is very little more than a shingled one, and it is surprising that this material is not in more general use, considering the saving in the matter of insurance.

The opening of the Walton Slate Quarries, near Richmond, in the township of Melborne, Canada East, will bring the article within the reach of the most thrifty house-builder. The slates from this quarry are equal to the best Welsh slate in formation and color, but they appear to us to have greater density, and consequently are more durable. For several years the Americans have had the monopoly of the slate market in this Province, limited as it was. Perhaps the inferiority of the American slate may in some measure account for the general preference hitherto given to shingle, tin and iron roofs. The American slate is uneven on the surface, and therefore does not fit well together. It is objectionable also to those who desire uniformity in the color of the roof; and besides, it is expensive. The Canadian slate is perfectly flat on the surface, easily laid on the roof, and of a beautiful uniform blue color. A roof of this slate costs little more than a good shingle roof, is ten times more durable, and is perfectly fire-proof.

The comparative cost of 100 superficial feet of the various kinds of roofing now in use in Toronto, from the best information we can obtain, is as follows:—Good shingle roof (the shingles laid in hair mortar), $4 50; Walton slate (12 × 6 in.), $5 50; do. do. (14 × 7 in.), $6 13; Iron roof, $14; Galvanized iron, $17. Of course, nearer the quarries the cost would be less.

It affords us great satisfaction to find that this valuable branch of Canadian industry is being vigorously prosecuted, and we wish its enterprising proprietor, Mr. B. Walton, every success.

EXHIBITION OF MANUFACTURES, &c.

The Toronto Mechanics' Institute, and the Toronto Electoral Division Society, have United to hold a Grand Exhibition in the New Hall of the Institute, commencing on Monday the 7th of October next, one week after the closing of the Provincial Exhibition in London, and to be continued open every day, from 10 a.m., to 10 p.m., for two weeks.

The rooms to be devoted to the purpose will be the Music Hall, in size 76ft. 6 inches by 54 ft 8 inches; the Lecture room, 51ft. by 42 ft.; and a suite of five other smaller rooms.

The total amount of prizes offered is nearly $1,000, with the option on the part of the holders of 1st prizes to accept a handsome diploma instead of money: and as the prizes will be open for competition to ALL THE PROVINCE, we have no doubt but there will be a good show.

The Mechanics' Institute will also hold a Bazaar in connexion with the exhibition, and solicit donations of articles for that purpose, the profits arising from which, as well as their share of the profits accruing from the Exhibition, will be devoted to the purchase of a suitable Organ for their Music Hall. The Secretary, Mr. Edwards, will furnish prize lists and Rules and Regulations to any parties applying for them.

The following is the classification of the prize list:—

ARTS AND MANUFACTURES.

Class
1. Cabinet Ware and other Wood Manufactures.
II. Fine and Decorative Arts.
III. Furs and Wearing apparel.
IV. Ladies' Work.
V. Machinery and Manufactures in Metals.
VI. Miscellaneous.
VII. Musical Instruments.
VIII. Paper, Printing, and Bookbinding.
IX. Saddlers' and Trunk Makers' Work.
X. Shoe and Boot Makers' Work.
XI. Woollen, Flax, and Cotton Goods.

HORTICULTURAL.
XII. Fruits.
XIII. Plants and Flowers.
XIV. Vegetables.

AGRICULTURAL.
XV. Dairy Products.
XVI. Grains.
XVII. Roots.

Correspondence.

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—In my letter inserted in last month's Journal, I referred in general terms to the great importance of connecting classes with every Mechanics' Institute. I beg now to direct the attention of your readers to the respective subjects of study which ought to commend themselves to the favour of the Directors and the members of these Institutes, and to suggest some of the methods that might be adopted for organizing such classes profitably and economically.

In selecting the subjects of instruction we may be best and most safely guided by the experiences of other Institutes, and the Report to the British Council of the Society for the encouragement of Arts, &c., furnishes abundant materials for forming the necessary estimate. This Report presents, among other very interesting subjects, a tabular view of the papers worked during the four years ending 1861, by the various candidates for certificates of merit and for prizes. The subjects of study amount altogether to thirty-two, but which when classified according to their relation with each other, may be reduced to seven or eight. This classification of kindred studies is of importance in the economy of the organization, since in most cases the same class, the same room, and the same Teacher would suffice for the study of all kindred subjects. Thus for example, there are twelve subjects mentioned under the heads of Arithmetic, Algebra, Geometry, &c., which any mathematical teacher of fair attainments could undertake in one class, whilst the subjects headed under the general terms of History, English, Logic and mental science, might be safely confided to the charge of a properly qualified English Teacher. Three or four qualified teachers might thus undertake the management of a very large number of studies, especially when it is remembered that the great body of the pupils would probably be earnest working students, and that the teacher would have little else to do than to give the necessary instruction.

In the report from which I am drawing the information, the subjects of study that have had preference are the following, the preference being given in the order in which I present them, viz: Arithmetic, Bookkeeping, Algebra, French, English Literature, Geography and Drawing. The various branches of the physical sciences do not appear to have claimed much attention whilst the students of these subjects have generally not pursued them with the same successful results as the students of the other subjects. Amongst these physical sciences I may name Chemistry as not only the most popular, but that in which the students have been the most successful in obtaining certificates. The study of chemistry does not demand such abstract reasoning nor are its problems generally of such difficulty as those of some of the other sciences, and as its pursuit is attended by so many interesting and exciting results in experimentalization, these circumstances may account for the preference given to it. It is possible that this and many other subjects may not be equal in their practical claims to some of the subjects mentioned in the Report, but the directors of all such institutes are not to forget that, whatever practical advantage may attend any special study, whatever necessity there may be for its pursuit, the great end, the highest object is *the moral issue won by engaging the working classes in the pursuit of knowledge.* In the Salford Institution Phonography has a first class work, and in other instances Music, Discussion, Chess, and pursuits of a similar necessary and practical character hold a prominent position. The result is, in most of these cases, satisfactory; the Institute by consulting and satisfying the legitimate tastes of its members advances its own prosperity and aids the great work of progress by encouraging the intellectual tendencies of the people. The first difficulty to overcome in the education of adults is their indisposition to any study. They fail in perseverance and the power of concentrativeness so necessary to the successful pursuit of any branch of knowledge; and the surest way to win them to enter the contest and to pursue it to its triumphs, is to let them enter upon it in their own fashion and according to their special tastes. In most cases study will grow into a habit, and the student beginning with a wayward and child-like mind will gather vigor and perseverance, and rise into the intellectual manhood which renders him capable of grappling with every difficulty and accomplishing every purpose.

As to the methods of conducting these classes, I am disposed to think that in all cases a system of systematic but familiar lectures, with constant examination, should be combined with class teaching. This method in the study of the physical sciences, and in the study of English Literature, of general or English History, and in fact of every subject which depends upon the explanation of principle and a memory of facts, is the best that can be adopted. A series of lectures for example on English History, a very popular subject in the British Institute, and one which secured for its students a very large proportion of certificates, might embrace an entire outline of Blackstone's Commentaries, combined with Hallam's Constitutional History, while the students might store their memories with all necessary facts and dates from a good text book, and a comprehensive and excellent knowledge of great historical events and principles could thus be acquired in one winter session, available for almost any position which the student might fill in after life. I make this brief reference to a method because it is too often the practice for teacher and student to go on the old beaten track of sitting at the desk night after night and passing through all the dull and dry details of a text book with no pleasing or satisfactory result. The friends of Mechanics' Institutes cannot be too often reminded that to make the classes successful the instruction must be made attractive, clear, and satisfactory, and the student

must be interested and enabled to feel that he is making progress.

I have other suggestions to make on these subjects, but for the present I presume I have trespassed quite enough on your columns.

I am, Sir,

Very respectfully yours,

R. L.

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—The time is approaching for the holding of the next Provincial Exhibition, which it is announced will take place in the city of London, during the last week of September next.

I see by the "Rules and Regulations" of the Association, as published in the last number of your Journal that entries in all but Horticultural, Ladies' and Foreign Classes, must be sent in to the Secretary by the 31st of August instant. I trust, sir, that these regulations will be strictly carried out, and that entries will not be taken, as heretofore, up to the very hour appointed for opening the Exhibition.

The evils arising from the systematic departure from the rules must have been apparent to every one who has had any thing to do with these Exhibitions; and always result in throwing excessive labour upon the Secretary and his assistants at a time when other duties require their attention, whereby numerous mistakes in the entries, and in the filling up of competitors' tickets, and dissatisfaction on the part of Exhibitors suffering from these mistakes, are sure to be the consequence. I would also urge upon your readers, and especially those intending to exhibit in the Arts and Manufactures' departments, not only to see that their entries are made in good time, but that their articles are delivered on the exhibition grounds a day or two before the exhibition opens, whenever such delivery is possible, so that the parties in charge of this department may have sufficient time to properly classify and arrange the goods.

Having had to act as a judge on two or three former occasions, I can speak of the difficulties often experienced in finding the goods that have been entered; and this is not to be wondered at when we see a large proportion of the articles coming in up to the very moment that the judges commence their duties. Complaints are often heard from visitors of the absence of a proper classification of goods, but considering the want of punctuality on the part of exhibitors in making their entries, and in delivering the articles entered, the only wonder is that, from the chaos usually presented on the mornings for opening these exhibitions, anything approaching a correct and systematic classification can be effected.

E. S.

Toronto, July 14th, 1861.

NOTICES OF BOOKS.

The Theory and Practice of Landscape Painting in Water Colours, by Geo. Barnard. London: Routledge, Warne & Routledge. Toronto: Rollo & Adam. 3rd edition.

A new edition of this work, valuable to art students, has recently issued from the press. Among the many works which the revived taste in water-colour painting has of late years called forth, none possesses more eminently than that under notice the qualities so desirable in a book of this description, affording as it does elementary instruction in an easy and simple manner, and being also a compendious guide and admirable book of reference to the more advanced student.

The study of colour, on truly scientific principles, is seldom presented to the mind of the young artist. Examples of colour treatment, even by the best artists, are not in themselves sufficient to form the basis of a well grounded education in the art. It is necessary that the student should acquire a thorough knowledge of the natural philosophy of colour, which the author has taken much pains to elucidate at the commencement of the work, by a variety of colored diagrams, and several well written chapters, which cannot fail to accomplish this most important object. The work contains a great variety of examples from the best masters, to illustrate the different effects of light and shade in the picture. The book is also ornamented by several beautiful landscapes, printed in oil.

A very important feature in the preparation of this edition, is a lengthened series of notes, containing answers to correspondents, who had addressed the author on certain difficulties. We select the following as an example:

Question 12.—"Why do artists so often introduce into their pictures the red cloak and blue kerchief, so prevalent in many of the rustic districts of England?"

Ans.—"Every one has heard of the good effect of a little bit of red contrasted with a large quantity of green. It is in fact so well known, and so much used, that it is not advisable to employ it too often. Blue, as a piece of positive colour, gives force and life to a picture, and serves to repeat the blue of the sky or distance. Of the two, red would appear conspicuous the largest in the distance; the blue contrasted with the warmer tones of the foreground, might be made the most striking."

The Life of North American Insects. By Prof, B. Jaeger, assisted by H. C. Preston, M. D., ; with numerous illustrations from specimens in the cabinet of the author. 1 vol., 12 mo.; New York: Harper & Bro.

There is no doubt that the difficulties attending the prosecution of a pursuit deter many from entering upon it. Such is especially found to be the case in the study of the Natural Sciences,—in this country more particularly, inasmuch as so few elementary books on these subjects, that are adapted to our wants, can be procured.

It is therefore with feelings of great satisfaction that we wish to draw attention to the work before us, one of the first of the kind that has appeared on this side of the Atlantic. Hitherto those among us who have been desirous of commencing the study of Entomology, have been compelled to seek for information chiefly from English books, describing only British insects, very few of which are of the same species as those found in this country. No work, at all intelligible to beginners, prior to the one before us, has given descriptions of Canadian insects, with the exception of Gosse's Canadian Naturalist,—a truly charming book, but not easily obtained here. A few papers on butterflies have appeared in the Canadian Naturalist, published by the Natural History Society of Montreal, and some also on *Coleoptera*, in the early volumes of the Canadian Journal. With these few exceptions, the Canadian student has been forced to put up with the little information he could glean from English books; though we by no means wish it to be inferred that we despise the other works mentioned above,—on the contrary, we found them in our own case, when we first began the study of Entomology, eminently serviceable; but we fear that they are not generally accessible to those of our youth who are desirous of commencing this pursuit. While we hail this little work as the precursor of, it is to be hoped, many others on kindred subjects, we cannot regard it as entirely free from faults, nor as even coming up to what might justly have been expected.

The author treats of seven of the orders of insects, namely:—*Coleoptera*, (Beetles); *Hemiptera*, (Bugs); *Orthoptera*, (Straight-winged Insects); *Lepidoptera*, (Butterflies and Moths); *Neuroptera*, (Net-winged Insects); *Hymenoptera*, (Vein-winged); and *Diptera*, (Two-winged). He writes with all the enthusiasm of one devoted to the study of this department of science, though he not seldom goes off into long digressions, introducing matter quite foreign to the subject in hand. On the whole, however, we recommend it to beginners in Entomology, as a book that will prove useful to them at first; of course one who has made some advance in the science will not expect to learn much from a book of this kind, written as it is in a popular style, and designed for the use of the public in general.

The Scientific American. Editors & Proprietors: Messrs. Munn & Co., No. 37, Park Row, New York.

This excellent periodical has recently entered upon its *fifth* volume (New Series), and is now in its *seventeenth* year. It is, we understand, the only journal at present published in the United States devoted to the mechanical arts and popular sciences. The volume lately closed has been in a preëminent degree remarkable for the richness and varied nature of its contents, containing as it has done accounts and descriptions, not only of domestic improvements and inventions, but also of those of foreign countries, all, too, profusely illustrated. To Mechanics, Artizans and Manufacturers, in every branch of industry, this work is, we may say, indispensable, since it furnishes the most authentic and complete intelligence respecting all new devices of inventive genius and fresh marvels in scientific discovery. The Inventor, Builder, Artist, Engineer, Manufacturer, in fact persons of almost every class, will find this periodical most useful and instructive, as well as exceedingly entertaining, and, to crown all, it is a perfect marvel of cheapness. Two beautifully printed volumes are published every year, containing upwards of four hundred pages each of reading matter, illustrated with a great number of very well executed engravings, designed expressly for the work; and all at the low price of *two* dollars a year, paid in advance. We can confidently assert that no one who subscribes to this journal will regard money so spent as wasted or thrown away.

Selected Articles.

A NEW METHOD OF PRODUCING ON GLASS, PHOTOGRAPHS OR OTHER PICTURES, IN ENAMEL COLOURS.

BY F. JOUBERT.

Of all the inventions to which the genius of man has given birth, and which have been progressively developed and brought, by his industry, to a high degree of perfection and usefulness, the art of glass making is certainly one of the most interesting and extraordinary, at the same time as it is doutbtless one which has tended to increase our comforts and our enjoyments in a degree almost unequalled by any other discovery of modern civilization.

If we look back to dark ages, and find that in those days even the rulers of the earth had no means of keeping rain and bad weather from their habitations, except by also shutting out the light, we shall be ready to acknowledge the astonishing results, as compared with the present state of things around us, which the persevering efforts of man have, under the guidance of an ever merciful Providence, been able to accomplish.

Before entering into the description of the process which is more immediately the subject of our meeting this evening, I would, in a concise manner, recapitulate the history and progress of the invention of glass itself, and of glass painting which has led to the process before us.

We have no distinct evidence to show what nation first used glass, and we must therefore be satisfied with the various traditions transmitted to us, from age to age, on the subject. One fact, however, seems established beyond the possibility of a doubt, viz.: that the greatest antiquity can be assigned to this invention, since the Egyptians and the Phœnicians had both vessels and ornaments made of glass, crude in form but of a substance so perfect, by whatever means obtained, that it has stood the trial of several thousand years, and may be pronounced to have suffered no deterioration. Might we not, in consequence, assign to glass a place in the list of useful inventions far higher than that which it occupies; for in this we have a discovery the first inventors of which attained at once, the very condition—durability—which human kind is incessantly bent upon obtaining for any produce of its hands.

But still more remote is the mention of glass in the Holy Scripture; for if the interpretation of the

text be a correct one, in the 18th chapter of Job, as also in several other parts of the Bible, is found an allusion to a substance which we imagine must have been glass. Next to this Alexander Aphrodisius amongst the ancient Greeks, Lucretius, Flavius Vopiscus, and other Latin authors, have left us a correct description of glass. Aristophanes also alludes to glass in one of his plays, and Aristotle brings out two problems on the subject; the first, why is it we see through glass? the second, why can we not bend glass?

Admitting that these two propositions emanate from the celebrated philosopher, they appear to give conclusive evidence that glass was familiar to the Greeks.

But we may, perhaps, even trace the origin of this invention far earlier, and to the remotest period of the existence of man, by associating it with the art of making bricks, which was, it is believed, practised by the earliest inhabitants of the earth; and it is not difficult to imagine how such an art would originate.

Man was led, for his subsistence, to seek a mode of preparing animal food for his use by roasting it over the fire, and having, in course of time, built, rudely, a sort of oven made of earth, and the earth having become hardened through the action of the fire, our forefathers would soon discover all the advantages which might be derived from such a process for making bricks or pots, and utensils for common use. Specimens of the potters art in ancient times we have in plenty, and in a variety of forms or shapes, which for elegance have not been surpassed. We need only allude to the Etruscan vases in the collection of the British Museum.

In firing bricks it will not unfrequently happen that some kind of vitrification takes place in the bricks placed in the hottest part of the fire, and one might naturally suppose that one process would lead to the other, but such does not appear to have been the case, at any rate, for many centuries. Later, horn and skins were in use down to the third or fourth centuries of the Christian era, and oiled paper or mica was also used in lieu of window glass, nearly up to the time of the reign of Elizabeth. If we are to give credence to the narrative of Pliny, to accident alone, as in many other instances, are we indebted for the discovery of glass. Some traders, being weather-bound landed on the banks of a river in Syria, and began to prepare a place in the sand for cooking their meals, after having gathered for fuel a great quantity of an herb, known there by the name of *kali*, which plant must have contained a large proportion of carbonate of soda, and this being mixed with the sand, yielded, through the agency of fire, a sort of vitreous substance. Such is one of the accredited versions of the origin of glass.

Glass has at all times, until recently, been thought a substance of great importance, and even amongst the primitive inhabitants of South America and of the Indian continent who were, when first visited by the early European navigators, found to possess gold and silver ornaments in great abundance, it is well known that the first discoverers of those countries who happened to land in search of food or water, had no difficulty in obtaining from the natives gold in exchange for some valueless pieces of glass, or a few glass beads which they would immediately use as an ornament round their necks or their wrists. As late as the middle of the last century, glass beads of various descriptions and of all sorts of colours, were extensively manufactured in France, principally for exportation to the colonies of South America and the islands of the Pacific Ocean.

It may be said that although glass is an article of first necessity to us, it is at the same time one with the nature of which very few persons are well acquainted, and the learned have even been often at variance as to the exact classification glass ought to belong to. It is not a mineral, since it has never been found in a primitive state in any country, neither can it be placed in the vegetable kingdom.

Glass has become with us an article so singularly cheap and common, that we are apt to lose sight of its immensely diversified qualities; but if only considered from a philosophical point of view, we shall find that few of the substances which we have in daily use, either in a simple or compound state, can be compared to glass in point of importance and of usefulness. Firstly, unlike any mineral, it is inodorous and clean to the fingers, and does not lose any of its weight by usage or wear; it is always transparent, whether in a cold or red-hot state; it can take any shape whatever while in a state of fusion, and it retains it absolutely after it has cooled. It is capable of receiving the highest polish, and of taking any coloured tint, either on its surface or in its body; and it also has this peculiar and invaluable advantage that it does not retain the taste of any liquid or acid it may have contained; it is the most flexible of substances while in fusion, and becomes harder than any pure metal when once it has become cold; lastly, it is not liable to rust, nor to be consumed by fire.

The applications of glass are now so numerous that it is difficult to imagine any one branch of industry or of manufacture which could be carried on for a single day without the use of glass in one shape or another. To some of the most important amongst the sciences, such as chemistry, physics, astronomy, the use of glass is a matter of absolute necessity; and in proportion to the gradual and increasing requirements of these last-named sciences, especially astronomy, it will be found that the glass manufacturer has been obliged to perfect his mode of manipulation, and, by the aid of chemistry, has of late years obtained such magnificent results that the field for astronomical observation has thereby been considerably enlarged.

It appears that, although vessels made of glass had been in use for a considerable time previously, it was only about the third century of our era that glass began to be used for glazing windows. These consisted of an infinite number of small panes of various shapes, which were arranged to as to form certain designs for the ornamenting of windows in places of worship; glass having, on account of its rarity then been almost, if not entirely, confined to that use.

St. Jerome, who wrote in the fourth century, speaks of glass in church windows; and Grégoire de Tours relates, two hundred years later, in the year 525, that a soldier of the army of the King of the Visigoths, which had invaded Auvergne, entered a church through a window, of which he broke the glass. Fortunatus, Bishop of Poictiers, towards the end of the seventh century, describes with admiration the painted windows of the Cathedral of Paris. St. Philibert, also in the seventh century, had the windows of the celebrated Abbey of Jumieges, on the banks of the Seine, near Rouen decorated with glass.

At the beginning of the eighth century glass was

unknown in England, and it was Wilfrid, Bishop of York, who died in 709, who first introduced glass into England, by sending for some glass-makers from France, according to a record kept to this day. A few years later, St. Bennet, Abbot of Wearmouth, wishing to decorate the windows of his monastery, sent for some glass-makers, also from France, for it appears, from some authentic records, that the art of decorating windows with glass was practised in several parts of France, especially in Normandy, long before it was adopted in other countries.

It would seem that the art of staining glass was very early discovered, although no date can be correctly assigned to the period when stained glass for church windows was first used, The practice generally adopted was to make a sort of mosaic design, by placing an infinite number of small pieces of coloured glass together. This was in use for several centuries before the art of painting on glass, properly speaking, was discovered, which seems to have soon extensively spread and to have been cultivated by many excellent artists, to judge by the numerous specimens still in existence on the continent. But for the 16th century, so rich already in artistic talent, was reserved the glory of carrying glass painting to a degree of excellence which has never been equalled since, and the names of Jean Cousin and Bernard de Palissy will be honoured for ever, amongst the large phalanx of glass painters in all countries. The most remarkable painted windows, perhaps, in this country, are the windows of the various Colleges at Oxford, which were executed during the 17th century by Bernard Van Linge and his pupils. William Price also repaired some of the glass paintings in Queen's College, Oxford, and in Christ Church painted a remarkable composition from the design of Sir James Thornhill. Besides these may be mentioned the windows of Lichfield Cathedral, and several other very ancient windows in Christ Church, and especially in the residence of the Dean of Westminster, near the Abbey.

Having been for many years, professionally acquainted with printing in connection with the fine arts, and having observed the immense development the new art of photography has taken, and the large field it has opened for representing all sorts of subjects, of animated, as well as still life, it occurred to me that if a means could be found to print the photographic image on glass, as easily as it is done on paper, and through the agency of some chemical composition which would admit of employing ceramic or vitrifiable colours, and burning then in, a great result would be attained, and a new and considerable branch of industrial art might thereby be opened. Considering the numerous and various attempts which have, from time to time, been made to introduce a substitute for glass painting in the decoration of houses, I believe it can be said that a want was generally felt for supplying the growing taste for pictorial decoration ; for glass painting is an expensive process, and requires also a considerable time to obtain a perfect result. There is a process known as lithophany, or transparent china, or biscuit slabs, which are now made, in Germany principally. and some very good specimens can be seen, but although any kind of subjects, on a small scale, can thus be represented, and with good effect, the slabs are heavy and thick, and can never come into use as a substitute for glass painting. Some few years ago, a new mode, which was then termed, " potichomany," was introduced, which had for a short time very great success—I allude to the mode of pasting coloured prints inside a large glass bowl, or jar, and applying a thin layer of plaster Paris, in a liquid state, so as to fix the paper firmly, and create an opaque back-ground, by giving substance to the whole, when seen from a distance. Some very good specimens ot this were obtained, and it afforded for a time an agreeable occupation to many a young lady. Another mode has also been tried, and some very pretty results produced, by applying prints obtained by lithochromy, or lithographic printing in colours, on a pane of glass, and varnishing them at the back with copal or some such varnish ; these will for some time resist the effects of the weather when placed in a window, and this is perhaps the nearest approach to glass painting in point of effect yet achieved, but practically it does not answer, for the varnish will not stand exposure to the weather from outside, and the constant cleaning glass requires renders it liable to be injured, so that the design soon perishes.

In the mode which is now for the first time introduced, no such danger or liability need be feared, since the colour has been firmly fixed in the substance of the glass by fire, and, being composed of the same elementary materials, has become part of glass itself, and can only be destroyed by the glass being annihilated by breakage.

In order that the process may be very distinctly understood, I shall now describe it by reading that part of my specification which relates to the placing the image on the glass, fixing it, and passing it through the fire.

This invention has for its object improvements in reproducing photographic and other pictures, engravings, prints, devices, and designs, on the surface of glass, ceramic, and other substances requiring to be fired to fix the same thereon.

For this purpose, I proceed in the following way: —A piece of glass, which may be crown or flatted glass, being selected as free from defect as possible, is firstly well cleaned ; and held horizontally while a certain liquid is poured on it. This liquid is composed of a saturated solution of bichromate of ammonia in the proportion of five parts, honey and albumen three parts each, well mixed tegether, and thinned with from twenty to thirty parts of distilled water, the whole carefully filtered before using it. The prepartion of the solution, and the mixing up with other ingredients, should be conducted in a room from which light is partially excluded, or under yellow light, the same as in photographic operating rooms, so that the sensitiveness of the solution may not be diminished or destroyed.

In order to obtain a perfect transfer of the image to be reproduced, the piece of glass coated with the solution, which has been properly dried by means of a gas stove (this will only occupy a few minutes) is placed face downwards on the subject to be copied in an ordinary pressure frame, such as is used for printing photographs.

The subject must be a positive picture on glass, or else on paper rendered transparent by waxing or other mode, and an exposure to the light will, in a few seconds, according to the state of the weather, show, on removing the coated glass from the pressure a frame, a faintly indicated picture in a negative condition. To bring it out, an enamel colour, in a very finely divided powder, is gently rubbed over with a soft brush until the whole composition or subject appears in a perfect positive form. It is then

fixed by alcohol in which a small quantity of acid, either nitric or acetic, has been mixed, being poured over the whole surface and drained off at one corner.

When the alcohol has completely evaporated, which will generally be the case in a very short time, the glass is quietly immersed horizontally, in a large pan of clean water, and left until the chromic solution has dissolved off, and nothing remains besides the enamel colours on the glass ; it is then allowed to dry by itself near a heated stove, and when dry is ready to be placed in the kiln for firing.

It may be stated that enamel of any colonr can be used, and that by careful registering, a variety of colours can be printed one after the other, so as to obtain a perfect imitation of a picture; also that borders of any description can be subsequently added, without any liability to remove or even diminish the intensity of the colour in the first firing.

It will be easy to perceive that this mode of obtaining an image on glass, in an absolutely permanent substance, and of any description, colour, or size, may prove of considerable advantage and utility for the decoration of private houses, and also for public buildings. Now that, by means of the photographic art, the most correct views of any object or of any building or scene—even portraits—can be faithfully and easily obtained ; when we see every day the results of the labours of photographers in all parts of the world, in the shape of beautiful prints ; when we can be made acquainted, without leaving home, with the actual costume, habitations, scenery, manners almost of all countries, for instance, China and Japan, which have but recently opened their doors to European civilisation : when, through the same means, we are able to see for the first time, and the learned are able to translate from, the graphic reproduction with which photography furnishes us of those early inscriptions engraved on the rocks in Asia, and by the Egyptians on their splendid monuments, I need only point out the usefulness of the mode of fixing those images, in an indelible manner, for ornamental as well as for scientific purposes.

In large cities, like London, where houses are built so close to one another, in how many places may not the process become available, by enabling any one to introduce, for a moderate expense, pleasing or instructive images where common plain ground glass is now used, to shut out the sight of a disagreeable object, a dead wall, or an unpleasant neighbour, without diminishing the amount of light more than is convenient.

In the library, fitting subjects might be introduced on the windows by a judicious selection of the portraits of favourite authors, or of famous scenery at home or abroad. In the dining room, also, appropriate pictures could be selected, such as flowers, fruit, or game subjects, so disposed as to harmonise with the decoration of the room. Even for domestic purposes, for lamps. or screens, or any object in glass, the process will be found useful, especially on account of its rapidity, which will enable the manufacturer to execute and to deliver an order at a very few days notice.—*Journal of the Society of Arts.*

ON FILTRATION AND FILTERING MEDIA.

The following article on this subject will be found worthy of the perusal and consideration of all those who are interested in obtaining pure water for consumption. We may remark that animal charcoal has long been employed as a filtering agent, not only for water, but also for the purpose of removing impurities from other liquids :—

A paper was recently read before the the Society of Arts of London, "On Filtration and Filtering Media," by Julius G. Dahlke. From various modern works upon the civilization of the Egyptians, Chinese, Japanese, and other ancient Oriental nations, we learn that at a very early period filters were used by them. These appear to have been vessels made of unglazed earthenware, or of porous stone. There is no evidence to show either that they were acquainted with the true nature of those matters which should be separated from water intended for the use of man, or that they had studied the subject of filtration in a scientific spirit. In this neglect Europe imitated them until near the close of the seventeenth or beginning of the eighteenth century, when the French began to pay attention to the subject, and employed silk, wool, cotton, sponge and sand as their filtering media. But about the middle of last century a lias was discovered in Picardy, which, owing to its effective action, came largely into use. The mode of using it was particularly simple, being in the form of a false bottom placed in the cistern, through which the water descended. Afterwards the attention of Englishmen was directed to the subject, and about seventy years ago filters were introduced which contained three layers of media, viz., sand, gravel and charcoal. These were for filtering by descent, but another system was subsequently adopted and patented for filtering by ascent ; this however, was complicated, and never became in any way largely known.

During the past seventy years, gravel, sand, and charcoal used as a mixture have been the agents most in vogue amongst filter makers, and it is only lately that due attention has been paid to charcoal as the most efficient filtering medium. Its use is much more frequent now, because not only has it a powerful detergent effect, but it possesses also the peculiar advantage of not becoming foul, while it protects from decomposition other bodies in contact with it. It has been often asked why animal charcoal is so effective as a filtering medium ? Some attribute this to the presence of so much carbon ; but that is an insufficient reason, as shown by the fact that, although coke contains more carbon than sand, yet it is not superior as a filtering agent. Animal charcoal filters about three and a half times more rapidly than either coke or sand, while it is also greatly superior in this, that it removes many inorganic impurities held in solution, over which the former substances exert no power. It appears that the more porosity a filtering medium possesses in itself, the more rapidly does it filter, and the greater is the effect it produces on the water. The latter will be still more decided when, with a greater porosity, peculiar substances are combined. This leads me to believe that we may attribute the extraordinary filtering quality of animal charcoal to the fact that its principal component parts are lime and carbon, so combined as to secure a wonderfully fine porosity. Vegetable charcoal, although very porous and containing far more carbon, has less effect upon water.

The art of filtration may be classed into three systems, viz :—1st, where the action takes place

simply on the surface of the filtering medium; 2nd, where the whole bulk of the filtering medium is calculated to operate on the water, and the detergent effect in its most delicate form may be produced; and 3rd, where both of these systems are conjointly employed. The first system requires a filtering medium of such a fine porosity that its pores must be smaller than the minute particles composing the impurities suspended in the water. Such an agent of course must sooner become clogged than a filtering medium of coarser porosity, and which is meant to act with its whole bulk on the water. But both systems employed together may prove to be useful in several instances, as in the case of domestic filters. The greatest failing of these is that they must become clogged, and the more they are liable to this the more effectively they act. We often hear of self-cleansing domestic filters, but the fact is that no invention of the kind has been made yet without involving complications too great for the purposes of ordinary domestic use.

However, it is not difficult to make a filter for general domestic purposes—although the effective self-cleansing of such an apparatus is still a problem to be solved.

The difficulty, or rather the impossibility, of keeping water which is stored in cisterns entirely free from accidental contamination, should lead us to provide a domestic filter capable of removing chemical impurities, as, for example, any lead which may be held in solution; in fact, the practice of filtering water preserved in cisterns, and intended for domestic use, cannot be too warmly recommended. To remove lead from water, Professor Faraday recommends the practice of stirring up animal charcoal with water so contaminated, the same being then allowed to settle.

It will not be necessary to dwell upon the filtering processes required for large water-works as the supply is generally taken from such sources that the common sand filter-bed answers the purpose; and where the water is too hard for domestic uses the beautiful process of Dr. Clark will meet and remedy the evil.

Experience shows that it is not prudent to adopt the same means of purification for every kind of water, and I should make a difference in the treatment of the water used for domestic and that employed for manufacturing purposes. In the latter it will be often of the greatest importance to have the water pure as possible, whereas certain so-called impurities in water may not be at all injurious to health. When we consider that no one would call human blood impure which contains 420 grains of saline matter per gallon, we are not, perhaps, justified (of course, speaking in relation to health) in calling water impure which contains small quantities of certain saline matters, particularly as when we have no medical evidence that the small portions of them drunk in such water ever did any harm. Besides which, it should be remarked that the quantity of lime and magnesian salts drunk in water must be greatly exceeded in amount by that which enters the system in the food. Only those waters which contain much sulphate of lime and magnesia have been observed to derange the process of digestion—as, for instance, the waters of the New Red Sandstone.

Too pure water is distasteful, and unfitted for drinking purposes. In one case the water taken from a certain well, having a flat and disagreeable taste, proved, on analysis, to be remarkably free from impurities. In order to make this water more fit, or perhaps only more agreeable for use,—such arrangements were made that before it was filtered through a body of animal charcoal, some finely dissolved organic impurities were added to it, and which were, of course, acted upon by the charcoal. It was found that the mixed water had a pleasant taste, after filtration, and even that it was somewhat sparkling, though no difference was recognized in the unmixed water after it had passed through the same filter.

Experience has demonstrated that we could not employ a more powerful and efficient filtering medium than pure animal charcoal, in a well regulated, fine, porous, and solid state. Unfortunately, however, no method has yet, to my knowledge, been discovered by which this substance can be moulded into a convenient shape without diminishing more or less its filtering qualities. What is required is some material which will bind the particles together without glazing them. Attempts had been made to produce solid animal charcoal filters by moulding the charcoal with the aid of bitumen and carbonizing the latter; but it appears that the object in view cannot be arrived at in this way. In the first instance, as the proper consistency is not gained; next, by becoming glazed, the charcoal loses many of its good qualities, and at least, its rapidity in action will be diminished from its becoming less porous. Another serious objection to this medium, which is really a mixture of charcoal and coke, is to be found in the fact that the filtering power of charcoal to coke stands as 15 to 4. Mineral bitumen (*i. e.*, coal-tar and coal-pitch) will produce this fatal defect in a higher degree than vegetable bitumen, as it leaves more solid residue after carbonization. But animal charcoal will not adhere to it, and will not bind sufficiently, even when a great quantity of it is used, unless some vegetable charcoal is added. This in itself might not be looked upon as a great drawback, although it has not the filtering quality of animal charcoal, if it served to preserve the latter from the glazing effects of the carbonized bitumen; but it does not do this.

A composition which Mr. Dahlke had used successfully, was then described. He said: "Being in some degree familiar with the use of the residue which the Torbane hill mineral, sometimes called Boghead coal, leaves after distillation, I turned my attention to it. After some experiments, I found that this substance, when moulded with bitumen, ceased to be effective, as in the case with animal charcoal. I, however, eventually discovered that this material, when saturated with oily or fatty matter, will easily adhere by the addition of a comparatively small quantity of clay, and to be readily moulded. When well burnt, this mixture furnishes a very powerful filtering medium; it will remove color and smell from water, and will reduce its hardness considerably, while at the same time its rate of filtration equals that of charcoal. In fact, recent discoveries have led me to the belief that the residue of the Torbane-hill mineral alluded to deserves more attention than has hitherto been paid to it, for it appears to possess many valuable properties which have been vainly sought in other bodies; but having not yet finished my researches, I must confine myself on this occasion to speaking of it merely with regard to its application to filtering purposes. To make the mixture more effective, I

add to it bone-dust, not only for the sake of animal charcoal, but because it must necessarily shrink in the charring—an effect which enables me to regulate with great nicety the porosity of the filtering medium beforehand; for I find that the porosity of the mixture mainly depends upon the quantity and grain of the bone dust which enters into its composition. I have also found that the use of oil instead of water for moistening the clay, prevents the too great shrinking of the moulded mass in the drying and firing process. By means of the process just described, I can produce filter blocks of considerable size and of various shapes, by the use of which I am enabled to overcome a great many difficulties, and to work large quantities of water with a comparatively small filtering apparatus."

If the quantity of water to be filtered be so great that a very large filter-bed is required, Mr. Dahlke prefers employing the preparation of the Torbanehill mineral, as described in a granular state, rather than sand; for this reason, that it filters more than three times as quick, and is five times as light as the latter; consequently a ton of it will, by a layer of equal thickness, filter about sixteen times the quantity of water that a ton of sand would filter, with the advantage that the filtering would produce at the same time a greater decolorizing effect and a considerable softening of the water. A clogging from the precipitation of chalk is not likely to take place, as this substance is separated in a crystalline and granular state. Moreover, those particles of the material which become saturated with organic impurities may, through calcination, regain the greater part of their former efficiency.

Mr. Dahlke remarked, in conclusion, that filtration was not often resorted to on the Continent, with the exception of France and Holland. Manufacturers were very much afraid of adopting any improvements that demand an outlay of capital, and so in this case they would often prefer using impure water to spending their money upon apparatus for purifying it. As for the water used for domestic purposes in Germany, the people are so apt to look up to a paternal government, even in matters concerning their health, that they never think of purifying the water supplied to them. To this apathy of the public may be ascribed, in a great degree, the comparative failure of the English water-works at Berlin.—*London Engineer.*

CEMENTS.

(*Concluded from page* 189.)

Engineer's Cement.—Equal weights of red and white lead, with drying oil, spread on tow or canvas. This is an admirable composition for uniting large stones in cisterns, &c.

Iron Cement for Closing the Joints of Iron Pipes.—Take of Iron borings, coarsely powdered, 5 lbs; of powdered sal-ammoniac 2 oz.; of sulphur 1 oz.; and water sufficient to moisten it. This composition hardens rapidly; but if time can be allowed it sets more firmly without the sulphur. It must be used as soon as mixed, and rammed tightly into the joints.

Cement for Steam Pipes.—Good linseed oil varnish ground, with equal weights of white lead, oxide of manganese, and pipeclay.

Gad's Hydraulic Cement.—Powdered clay 3 lbs. oxide of iron 1 lb; and boiled oil to form a stiff paste.

Cements for Masonry of Chambers of Chlorine &c.—Equal parts of pitch, rosin, and plaster of Paris.

Roman Cement.—1 bushel of slacked lime; 3 ½lbs. of green copperas; and ½ bushel of fine gravel sand. The copperas should be dissolved in hot water. It must be stirred with a stick, and kept stirred continually while in use. Care should be taken to mix at once as much as may be requisite for one entire front, as it is very difficult to obtain the same shade or colour a second time. It ought to be mixed the same day it is used. This is the English Roman cement.

The genuine Roman cement consists of the pulvis puteolanus, or puzzolene, a ferruginous clay from Puteoli, calcined by the fires of Vesuvius, lime, and sand mixed with soft water. The only preparation which the puzzolene undergoes is that of pounding and sifting; but the ingredients are occasionally mixed with bullock's blood and suet, to give the composition greater tenacity.

Seal Engravers' Cement.—Resin 1 part; brickdust 1 part. Mix with heat.

Marine Cement, commonly called Marine Glue.—Cut caoutchouc into small pieces, and dissolve it, by beat and agitation, in coal naptha. Add to this solution powdered shell-lac, and heat the whole, with constant stirring, until combination takes place; then pour it, while hot, on metal plates, to form sheets. When used, it must be heated to 280° Fah., and applied with a brush.

Liquid Glue.—Dissolve bruised orange shell-lac in ¾ of its weight of rectified spirit, or of rectified wood naptha, by a gentle heat. It is a very useful as a general cement and substitute for glue. Another kind may be made by dissolving 1 oz. of borax in 12 oz. soft water, adding 2 oz. of bruised shell-lac, and boiling till dissolved stirring it constantly.

Bank Note Glue.—Dissolve 1 lb. of fine glue, or gelatine, in water; evaporate it till most of the water is expelled; add ½ lb. of brown sugar, and pour it into moulds. Some add a little lemon juice. It is also made with 2 parts of dextrine, 2 of water, and 1 of spirit.

Maissiat's Cement, as an Air-Tight Covering for Bottles, &c.—Melt india-rubber (to which 15 per cent. of wax or tallow may be added), and gradually add finely powdered quick-lime, till a change of odor shows that combination has taken place, and a proper consistence is obtained.

Cement for Attaching Metal Letters on Plate Glass.—Copal varnish 15 parts; drying oil 5 parts; turpentine 3 parts; oil of turpentine 2 parts; liquified glue 5 parts. Melt in a water bath, and add 10 parts of slacked lime.

Japanese Cement.—Mix rice flour intimately with cold water, and boil gently.

French Cement.—Mix thick mucilage of gum arabic with powdered starch.

Stone Cement.—River sand 20 parts; litharge 2 parts; quick lime, one part. Mix, with linseed oil.

Plumbers, Cement.—Resin 1 part; brick-dust 2 parts. Mix, with heat.

Parisian Cement.—Gum arabic 1 oz.; water 2 oz.; sufficient starch to thicken.

Cement for Floors.—The following style of floor is well adapted for plain country dwellings: Take two thirds of lime, and one of coal ashes, well sifted, with a small quantity of loam clay; mix the whole together, temper it well with water, and make it up into a heap; let it lie six or seven days, and then temper it again. After this, heap it up for three or four days, and repeat the tempering very high, till it becomes smooth, yielding, tough, and gluey. The ground being then levelled, lay the floor therewith about 2½ or 3 inches thick, making it smooth with a trowel. The hotter the season is the better; when thoroughly dried it makes a capital floor. Should a *better looking* floor be desired, take lime of rag stones, well tempered with white of eggs, and cover the floor half an inch thick with it before the under flooring is too dry. If this be well done, and the floor thoroughly dried, it will look, when rubbed with a little oil, as transparent as metal, or glass.

Common Paste.—To a table-spoonful of flour add gradually half a pint of cold water, and mix till quite smooth; add a pinch of powdered alum (some add a small pinch of powdered rosin), and boil for a few moments, stirring constantly. The addition of a little brown sugar, and a few grains of corrosive sublimate, will, it is said by practical chemists, preserve it for years.

Soft Cement.—Melt yellow wax with half its weight of common turpentine, and stir in a little Venetian red, previously well dried and finely powdered. This cement does very well as temporary stopping for joints and openings in glass and other apparatus, where the heat and pressure are not great.

Lutes, or Cements, for closing the Joints of Apparatus.—Mix Paris plaster with water to a soft paste, and apply it immediately. It bears nearly a red heat. It may be rendered impervious by rubbing it over with wax and oil.

Another.—Slacked lime made into a paste with white of egg, or a solution of gelatine.

Another. Fat Lute.—Finely powdered clay, moistened with water, and beaten up with boiled linseed oil. Roll it into cylinders, and press it on the joints of the vessels, which must be perfectly dry. It is rendered more secure by binding with strips of linen moistened with white of egg.

Another.—Linseed meal beaten to a paste with water.

Another.—Slips of moistened bladder, smeared with white of egg.

Fire and Waterproof Cement.—To half a pint of milk put an equal quantity of vinegar, in order to curdle it; then separate the curd from the whey, and mix the latter with four or five eggs, beating the whole well together. When it is well mixed add a little lime through a seive, until it has acquired the consistance of a thick paste. With this cement broken vessels may be united. It resists water, and to a certain extent fire.

Fire Lutes.—The following composition will enable glass vessels to sustain an incredible degree of heat: Take fragments of porcelain, pulverise, and sift them well, and add an equal quantity of fine clay, previously softened with as much of a saturated solution of muriate of soda as is requisite to give the whole a proper consistence. Apply a thin and uniform coat of this composition to the glass vessels and allow it to dry slowly before they are put into the fire.

Another.—Equal parts of coarse and refractory clay, mixed with a little hair, form a good lute.

A Cement for stopping the Fissures of Iron Vessels.—Take two ounces of muriate of ammonia, 1 ounce of flour of sulphur, and 16 ounces of cast iron filings or turnings. Mix them well in a mortar, and keep the powder dry. When the cement is wanted, take one part of this and twenty parts of clean iron filings, or borings; grind them together in a mortar, mix them with water to a proper consistence, and apply them between the joints. This cement answers for flanges of pipes, &c., about steam-engines.

Genuine Armenian Cement—"The jewellers of Turkey, who are mostly Armenians," says Mr. Eaton, a very intelligent traveller, and at one time a resident and consul in that country, "have a singular method of ornamenting watch cases, &c., with diamonds and other precious stones, by simply gluing or cementing them on. The stone is set in silver or gold, and the lower part of the metal made flat, or to correspond with the part to which it is to be fixed. It is then warmed gently, and the glue applied, which is so very strong that the parts thus cemented never separate. This glue which will firmly unite bits of glass, and even polished steel, and may of course be applied to a vast variety of useful purposes, is thus made: Dissolve five or six bits of gum mastic, each the size of a large pea, in as much spirits of wine as will suffice to render it liquid; in another vessel dissolve as much isinglass previously a little softened in water (though none of the water must be used), in French brandy or good rum, as will make a two ounce phial of very strong glue, adding two small bits of gum galbanum or ammoniacum, which must be rubbed or ground till they are dissolved. Then mix the whole with a sufficient heat, keep the glue in a vial closely stopped, and when it is to be used set the vial in boiling water."

Another.—Thick isinglass glue 1 part; thick mastic varnish 1 part. Melt the glue, mix, and keep it in a closely corked phial. For use, put the phial in hot water.

Elastic Cement for Bells.—Dissolve in good brandy a sufficient quantity of isinglass, so as to be as thick as molasses.

A very strong Carpenters' Glue.—Dissolve an ounce of the best isinglass, with a moderate heat, in a pint of water. Take this solution, and strain it through a piece of cloth, and add to it a proportionate quantity of the best glue, which has been previously soaked for about twenty-four hours, and a gill of vinegar. After the whole of the materials have been brought into a solution, let it once boil up, and strain off the impurities. This glue is well adapted for any work which requires particular strength, and where the joints themselves do not contribute towards the combinations of the work; or in small fillets and mouldings, and carved patterns, that are held on the surface by the glue.

A Glue for inlaying Brass or Silver Strings, &c.—Melt your glue as usual, and to every pint add of finely powdered rosin and finely powdered brick-dust two spoonfuls each; incorporate the whole together, and it will hold the metal much faster than any common glue.

A strong Glue that will resist moisture.—Dissolve gum sandarac and mastic, of each ¼ of an ounce, in ¼ pint of spirit of wine, to which add ¼ of an ounce

of clear turpentine. Now take strong glue, or that in which isinglass has been dissolved; then, putting the gums into a double glue pot, add by degrees the glue, constantly stirring it over the fire till the whole is well mixed; then strain it through a cloth, and it is ready for use. You may now return it into the glue pot, and add ½ an ounce of very finely powdered glass; use it quite hot. If you join two pieces of wood together with it, you may, when perfectly hard and dry, immerse it in water and the joint will not separate.

A paste for laying Cloth or Leather on Table Tops.—To a pint of the best wheaten flour add two table spoonfuls of finely powdered rosin, and one spoonful of powdered alum. Mix them well together, put them into a pan, and add by degrees rain water, carefully stirring it till it is of the consistence of thinish cream; put it into a saucepan over a clear fire, keeping it constantly stirred, that it may not get lumpy. When it is of a stiff consistence, so that the spoon will stand upright in it, it is done enough. Be careful to stir it well from the bottom, for it will burn if not well attended to. Empty it out into a pan, and cover it over till cold, to prevent a skin forming on the top, which would make it lumpy. This paste is very superior for the purpose, and adhesive. To use it for cloth or baize spread the paste evenly and smoothly on the top of the table, and lay your cloth on it, pressing and smoothing it with a flat piece of wood; let it remain till dry: then trim the edges close to the cross-banding. If you cut it close at first it will, in drying, shrink and look bad where it meets the banding all around. If used for leather, the leather must be first previously damped and the paste then spread over it; then lay it on the table, and rub it smooth and level with a linen cloth and cut the edges close to the banding with a short knife. Some lay their table-cover with glue instead of paste, and for cloth perhaps it is the best method; but for leather it is not proper, as glue is apt to run through. In using it for cloth, great care must be taken that your glue is not two thin, and that you rub the cloth well down with a thick piece of wood made hot at the fire, for the glue soon chills. You may by this method cut off the edges close to the border at once.

Cement Stopping.—Mix equal quantities of sawdust, of the same wood required to be stopped, and clear glue; and with this stop up the holes or defects of the wood. Where the surface is to be japanned or painted, whiting may be used instead of sawdust. Be sure to let the stopping dry before you attempt to finish the surface.

Mahogany-coloured Cement.—Melt two ounces of beeswax, and half an ounce of rosin, together; then add half an ounce of Indian red, and a small quantity of yellow ochre to bring the cement to the desired colour. Keep it in a pipkin for use.

A Cement to stop Flaws or Cracks in wood of any colour.—Put any quantity of fine sawdust, of the same wood your work is made with, into an earthen pan, and pour boiling water upon it, stir it well, and let it remain for a week or ten days, occasionally stirring it; then boil it for some time, and it will be of the consistence of pulp or paste; put it into a coarse cloth, and squeeze all the moisture from it. Keep for use, and when wanted mix a sufficient quantity of thin glue to make it into a paste; rub it well into the cracks, or fill up the holes in your work with it. When quite hard and dry, clean your work off, and, if carefully done, you will scarcely discover the imperfection.

Fireproof Stucco for Wood, &c.—Take moist gravelly earth (previously washed), and make it into stucco with the following composition: Pearlashes two parts; water, five parts; common clay, one part. It has been tried on a large scale and found to answer.

Terra Cotta.—Potter's clay, Ryegate sand, and water, each a sufficient quantity. Model and bake.

Pew's Composition for covering Buildings.—Take the hardest and purest limestone (white marble is to be preferred), free from sand, clay or other matter; calcine it in a reverberatory furnace, pulverize and pass it through a seive. One part, by weight, is to be mixed with two parts of clay well baked and similarly pulverized, conducting the whole operation with great care. This forms the first powder. The second is to be made of one part of calcined and pulverized gypsum, to which is added two parts of clay, baked and pulverized. These two powders are to be combined, and intimately incorporated, so as to form a perfect mixture. When it is to be used, mix it with about a fourth part of its weight of water, added gradually, stirring the mass well the whole time, until it forms a thick paste, in which state it is to be spread like mortar upon the desired surface. It becomes in time as hard as stone, allows no moisture to penetrate, and is not cracked by heat. When well prepared it will last any length of time. When in its plastic or soft state, it may be coloured of any desired tint.

Miscellaneous.

Corn-Leaf and Grass Paper.

Paper has been and is now manufactured somewhat extensively from dry grass and straw, but P. W. Runel, of Plumstead, England, states he has made the discovery that paper pulp can be manufactured at less cost, by using green, instead of dry grasses, for its production He has taken out a patent for the improvement, and he states that when grass becomes dry its silica becomes hard and difficult of solution, whereas, when it is taken green, the silica and other unfibrous substances in it are more easily separated. He takes any green plants, such as sea grasses, which are abundant and cheap, and first mashes, then steeps them in warm water, and after this he boils them in a weak alkaline solution. They are now easily reduced to pulp by passing them between crushing rollers, or through the common beating engines used in paper mills. The pulp is bleached in the usual manner with chlorine.

The leaves of Indian corn are now used for making good paper, in Europe. There is one paper mill in operation in Switzerland, and another in Australia, in which paper is made from such leaves exclusively. The husks, which envelope the ears of corn, make the best quality. It is stated by the London *Mechanics' Magazine* to be excellent, and in some respects superior to that made from rags. As we are dependent upon Europe, in a great measure, for our supply of rags to make our paper, if we can obtain as good qualities from Indian corn leaves, we may yet become the manufacturers of paper for the whole world, as the greatest supply of cheap raw material is found in America. This is a subject worthy of deep attention, as we import rags to the value of about $1,500,000 annually, and paper manufactures to the value of about one million of dollars.

It is really wonderful to what uses paper may be applied, and what a field there is still left for improvements in its manufacture. We may take some instructions from the Japanese in this department of the arts. A writer in *Blackwood's Magazine*, in describing the manners of the Japanese, says:—"It is wonderful to see the thousand useful as well as ornamental purposes for which paper is applied in the hands of these industrious and tasteful people. Our *papier mache* manufacturers should go to Yedo to learn what can be done with paper. We saw it made into material closely resembling Russian and Morocco leather; it was very difficult to detect the difference. With the aid of lacker, varnish and skilful painting, paper makes excellent trunks, saddles, telescope-cases, the frames of microscopes; and we even saw and used excellent water-proof coats made of paper, which did keep out the rain, and were as supple as the best macintosh (india rubber). The Japanese use neither silk nor cotton handkerchiefs, towels or dusters; paper in their hands serves as an excellent substitute. It is soft, thin, and of a pale yellow colour, plentiful and cheap. The inner walls of many a Japanese apartment are formed of paper, being nothing more than painted screens. Their windows are covered with a fine translucent description of the same material. We saw what seemed to be balls of twine which were nothing but long shreds of tough paper rolled up. If a shopkeeper had a parcel to tie up he would take a strip of paper, roll it up quickly between his hands, and use it for twine. In short without paper, all Japan would come to a dead lock." The writer says "Japanese mothers-in-law invariably stipulate in the marriage settlement, that the bride is to have a certain quantity of paper allowed her."

The Japanese do not use rags for making paper, but the inner bark of trees.—*Scientific American.*

Machine-made Unfermented Bread.

Raised bread, resembling common loaves made from fermented and baked flour, is manufactured at present upon a somewhat extensive scale, on the corner of Fourteenth-street and Third avenue, in this city. The flour and water for making a batch of bread, are run into a large globular cast-iron vessel, and thoroughly mixed by a stirrer revolving inside, and driven by a steam engine. The lid of the iron vessel is then rendered perfectly air tight, and all the air is extracted by an air pump when the flour is thoroughly wet.

The mixed flour is thus expanded and rendered porous. Carbonic acid gas, under a considerable pressure, is now admitted among the dough, which is still continually stirred, until the whole mixture is charged with the gas. When this is effected, the operator takes his seat at the table under the vessel, and piles of tin pans are laid at his side. A tube projects down at the bottom of the iron vessel containing the dough. The operator now shoves a pan under this tube, opens the cock, when the pressure of the gas inside forces out the mixed dough in a stream, and the pan is filled in half a second. The pans are handed to the baker, who instantly places them in the oven. From the time the flour is placed in the iron vessel to be mixed, until it comes from the oven in the form of bread, the time occupied is only one hour. This is a rapid method of making bread, and as the labour is mostly performed by machinery, the cost of its manufacture is less than for making fermented bread. We have seen raised bread made by charging the water with carbonic acid gas, instead of charging the dough, but the bread by the latter method was considered much the better. We understand that there is now a very large demand for this bread, and that the machinery is kept running day and night to supply it. The taste is slightly different from bread made by fermentation. There are no fears of the dough becoming sour during warm weather by the carbonic acid gas process.

The inventor (Mr. E. Fitzgerald) of this system of bread making, has also devised an apparatus which will soon be applied, by which the loaves will be weighed by self-acting mechanism, and the pans filled with the dough, at one continuous operation.—*Scientific American.*

Working in Aluminum.

The following valuable article is from the *Ironmonger* (English). The information was obtained from Messrs. Bell & Brothers, of Newcastle-on-Tyne, manufacturers of aluminum, by Professor Deville's process, and will be very useful to many of our readers:—

The peculiar properties of this substance having been so little understood, has hitherto hindered its general employment, but now that it is sold in a pure state at as low a rate as 50s. per pound avoirdupois, it is likely to be much more frequently used.

Aluminum is a metal of fine white colour, slightly inclining to blue, especially after being well hammered when cold.

Aluminum, like silver, is susceptible of a very fine "matting," which is not affected by exposure to the air, or by any of the impurities usually present in the atmosphere of towns. To obtain this matting, the aluminum objects (being previously washed in benzole or essence of turpentine) must be plunged into a weak solution of caustic soda, thoroughly well washed, and exposed to the action of strong nitric acid. When the desired matting has been obtained, it must be well washed again, and dried in sawdust.

Aluminum is easily polished or burnished. To do this, it is necssary to use a mixture of equal parts of rum and olive oil, as an intermediate substance between it and the polishing stone or powder used. The polishing stone is steeped in this mixture, and will then burnish aluminum in the same manner as gold and silver is burnished, care been taken not to press too heavily upon the burnishing instrument.

Aluminum can be beaten out, either hot or cold, to the same extent and as perfectly as gold or silver; and it is susceptible of being rolled in much the same way as either of the above metals. Leaves as thin as those used for gilding and silvering can be made of aluminum. Covered ingot moulds of iron answer best for receiving aluminum intended to be used in the rolling mill. Aluminum quickly loses its temper, and therefore requires frequent reheating. The temperature of this reheating is a dull red heat, and when the plates become very thin, this demands the greatest attention.

Aluminum is easily drawn into wire. For this, the ingots are run into an open mould, so as to form a kind of quadrangular shape of a little less than half-inch section, which is then beaten upon the edges by the hammer very regularly; the operation of drawing out is then commenced on a horizontal bench, by very gradually reducing the diameter of the metal intended to be drawn into wire, and by frequent reheating, and then the ordinary process of wire-drawing can be proceeded with. When the threads are required extremely fine—as, for example, for the manufacture of lace—the heating becomes a very delicate operation, on account of the fineness of the threads and the fusibility of the metal. The heat of the current of air issuing from the top of the glass chimney of an Argand lamp will suffice for the heating.

The elasticity of aluminum is very much the same as that of silver, and its tenacity also about the same. The moment after it has been melted, aluminum possesses about the hardness of pure silver; when it is hammered out, it almost resembles that of soft iron; it becomes

elastic, acquiring, at the same time, considerable rigidity, and emits the sound of steel when suffered to fall upon a hard body.

A property which aluminum manifests in a high degree is that of excessive sonorousness. This property has already rendered it of service in the construction of several musical instruments.

Aluminum is much lighter than ordinary metals. Its density is 2·56, a quarter that of silver, and about a third that of iron. By the action of the hammer, the density of aluminum increases sensibly, so as to become equal to 2.67.

Aluminum melts at a higher temperature than zinc, and a lower one than silver; to melt it, an ordinary earthenware crucible must be employed, without the addition of any sort of flux.

Its lower point of fusion, along with its slowness of heating, require that for melting it a less intense fire should be used, but applied for a longer time than in melting silver.

It is easily melted in an open crucible, which facilitates the removal of the dust and other impurities which appear on the surface of the metal; and for the purpose of stirring the entire mass a clean iron spatula is used.

Aluminum is easily run into metallic moulds; and still better, for objects of a complicated form, into moulds of dry porous sand, formed so as to allow an easy passage for the air expelled by the metal, which is viscous when melted. It ought to contain a greater number of passage holes, and should be so managed as to run it in one long and perfectly cylindrical git. When heated to a red heat, it ought to be poured out with tolerable rapidity. A small portion of the fused metal should be caused to run into the git itself when full, to compensate for the contraction of the substance of the metal at the moment of solidification.

By following all these precautions, castings of the highest degree of fineness may be obtained; but, at the same time, to succeed perfectly, an especial acquaintance with the subject is needed.

In the production of work where the use of the lathe becomes necessary, any scratching or tearing of the metal by the tool is avoided by covering the surface to which the tool is applied with a varnish composed of stearic acid and essence of turpentine.

When aluminum is soiled by greasy matters, it can be cleaned by benzole; if it be soiled by dust only, india-rubber or very weak soap and water may be used.

The pieces of aluminum intended to be soldered must be prepared in the same manner as objects are treated for soldering with tin, viz., by a "tinning;" but it must be remembered that it is indispensable that this tinning must take place with the solder itself. The pieces to be soldered, thus tinned beforehand, are afterwards joined together and exposed to the flame either of a gas blowpipe, or any of the ordinary sources of heat used in such cases. In order to unite the solderings, small tools of aluminum are used. These tools are used as little soldering instruments, and they facilitate at the same time the fusion of the soldier and its adhesion to the previously prepared aluminum.

The use of tools of copper or brass used when soldering gold and silver, must be strictly avoided, as they would form colored alloys with the aluminum and the solder. It is of the greatest importance never to use any flux to cause the solder to melt, as all those at present known attack aluminum, and prevent the adhesion of the pieces to be soldered. The use of the little tools of aluminum is an art which the workmen must acquire by practice; in fact, at the moment of fusion the soldering must have the friction applied, as they melt suddenly in a complete manner. In soldering aluminum, it is well to have both hands free, and to use only the foot for the blowing apparatus.

Solders of different compositions and degrees of fusibility have been employed in soldering aluminum. The following are those which have been generally used, ranged according to their order of fusibility:—

	1.	2.	3.	4.	5.
Zinc	80	85	88	90	94
Copper	8	6	5	4	2
Aluminum	12	9	7	6	4

No. 4 is the one usually preferred, particularly for soldering smaller objects.

In order to make the solder, the copper is first melted, the necessary aluminum is added, and stirred by means of an iron spatula, unpolished, as it comes from the blacksmith, adding also a little tallow; the zinc is then added, avoiding too much heat, as this last metal is easily oxydized and is very volatile.

The Nova Scotia Gold Fields.

Gold was discovered last year in the river Tangier, a rather inaccessible part of Nova Scotia. The announcement of this discovery, as is usual in such cases, created great excitement in the neighbouring country; but that reliable information might be afforded to those interested in the matter, a scientific investigation has been made by a geologist, who has arrived at the conclusion, after having made careful examinations on the spot, that gold does not exist in sufficiently large quantities to remunerate searchers after it, unless the aid of machinery were employed, which would, of course, require the outlay of some capital. Further investigation, however, has served to show that gold exists in larger quantities than was at first imagined. The following extract from the Halifax *Chronicle* will serve to shew what is now being done at these mines:—

"While much of the excitment attending the first few weeks of the Tangier gold fever has passed away, still a lively interest exists in the community on the subject, kept up by reports reaching the city almost daily, of the increasing productiveness of the Tangier mines, or of new discoveries at other places along the coast. Within the last week, rumors of such findings at Tangier have reached town, all of which rumors it would perhaps be absurd to believe; but after making a liberal allowance for exaggeration, enough remains to show that the quartz vein from which the chief quantity has been obtained, appears to grow richer the further it is followed from the surface, and also that other veins which near the surface appear to contain no gold, have proved, after a further trial, to be auriferous. The number of men at work at that locality at the present time is estimated at about five hundred. A good road has been constructed from the shore to the scene of operations. Shanties of a more comfortable character than the brush camps and canvas tents in which the diggers at first sheltered themselves from the weather, are being erected. Shops for supplying the miners with provisions and other necessaries are being opened. These indications all speak of the belief of those at work on the spot, in the value of the discoveries; and indeed there is no longer room to doubt that gold in considerable quantities exists there; but still we see no reason to change the opinion expressed some weeks ago, as to the improbability of single handed labour proving other than ruinous to nineteen-twentieths of those who seek by individual efforts to make a fortune at the gold diggings. The geological structure of the district in which the gold is

found, is such that the precious metal can only be obtained in valuable quantities by the application of capital and skilled labour, and that on a pretty extensive scale. The prevailing rock is a species of coarse clay slate, interspersed with numerous small veins of quartz, the whole being, at the spot where the gold is found, nearly vertical, or dipping at an angle of not less than 70 or 80 degrees to the southward. The system of mining pursued is the rudest and most primitive possible. A trench is opened in the rock, three or four feet wide, and across the whole width of a claim, or twenty feet along the strike of the vein. In this the diggers work with pick and crowbar, patiently picking away the slate from each side of the quartz, the richest vein of which yet discovered, is only from three to five inches thick, and when a few inches of the vein is exposed it is broken off in lumps of a few pounds weight, and thrown to the surface, where a man with a hammer reduces it to small pieces, and picks out such specks of gold as he may discover with the naked eye. This, up to the present time, has been the whole system of gold mining at Tangier. Primitive as is the mode of working, however, it has served to prove that gold does exist there and in considerable quantities: and if the quartz taken out by this process has yielded an average of twenty ounces per ton, which we believe is the fact, then it only needs that the business of mining should be conducted on proper principles and on a sufficiently extensive scale, and approved machinery used for crushing the rock and and extracting the gold, in order that Tangier should rival some of the famed quartz regions of California and Australia."

Rock Oil as fuel for Steam-Engines.

A correspondent of the *Scientific American* says: An application of the rock oil of Pennsylvania for generating steam for motive power under steam-engine boilers is exciting much attention in the oil region. The following is a description of the apparatus used: A series of iron pipes are laid in the fire arch of the boiler, which pipes are perforated in their upper surface with minute holes: the oil is supplied to those pipes by means of a force pump, aided by an air receiver, to preserve a constant pressure. A spray, so to speak, of oil is thus made to fill the space usually filled by the flame of wood or coal used to rise steam; this, once ignited, fills the fire arch and flues of the boiler, and maintains the amount of heat in the boiler.

If this fuel is not found to be too expensive, it will prove a good thing for the use of steamers on sea voyages. Its practical use has been proved, and it remains for chemists and others to test it on ships, &c., in a large way.

There can be but little doubt that this oil will be found cheaper than coal for gas-making for lighting dwellings, streets, &c.; its price, under the influence of the vast supply raised, will soon come down to a matter of fifteen or twenty cents per gallon.

ADOLPH BERGER, C. E.

Buffalo, N. Y.

Steam Superheating.

All the benefits obtained from superheating steam by passing it through tubes in a furnace before it is admitted into the cylinders, it is stated to be obtained by keeping steam in a jacket surrounding the cylinder, and maintaining it at a temperature somewhat above that which operates the piston. It has been found in practice that the very dry steam which is produced in the tubes running through a furnace cuts the cylinders and packing. The London *Engineer* states that steam jacketting has lately been introduced into the British navy, and has been applied to two vessels, the *Gibraltar* and *Atlas*. "In commercial steamers jacketted cylinders are being extensively adopted."—*Scientific American.*

Iron in Buildings—Useful Rules.

The London *Building News* publishes an abstract of a very useful paper by Mr. Wm. Stubbs, lately read before the Liverpool Architectural Society. We quote the following extract from it:—

The golden age is past: we are now in the age of iron. * * * It may be truly said that gravity is the ultimate source of all the strains that arise in buildings, but for convenience it is necessary to resolve the resultant into compression and tension. It was formerly usual to employ iron chiefly to resist the latter, but economy of space and length of bearing have brought both into its service. * * * The first point to be ascertained by an architect with a casting of iron is to find out what it has to do.

The practical man wants simple tools. Science is always consistent with successful practice, therefore simple rules are sufficient. The following for iron pipes of ordinary sizes answers well, and it never has been published before. It is based upon the fact that a 10 inch pipe one inch thick will stand the pressure of 100 yards head of water. The coincidence of one inch of metal to every 10-inch diameter and 100 yards pressure should be remembered. For every inch in the diameter of pipe, increase or deduct one-tenth of an inch, and for every yard of pressure increase or deduct one hundredth of an inch.

In calculating the strength of columns great care is necessary. The safe plan is to find the diameter of a solid column necessary to bear the compression, and then distribute the same area of metal in tube form as a hollow column. * * * A solid column 10 feet long, and having an area of 10 square inches (good metal,) will bear 10 tons pressure. This rule can be conveniently carried out, and it is safe and practical. It is really not so much what we know as what we can successfully use that is valuable in science and art.—*Scientific American.*

Ventilating Water-proof Cloth.

India-rubber and oilcloth capes and coats, although perfectly water-proof, are unfit for wearing during warm rainy weather, because they retain the prespiration and prevent the necessary ventilation required for the body. The best light capes for soldiers and travelers when marching during wet weather, are made of what is called "Tweed cloth," prepared as follows:—Take 2lbs 4 oz. of alum, and dissolve it in 10 gallons of water; in like manner dissolve the same quantity of sugar of lead in a similar quantity of water, and mix the two together. The cloth is immersed for an hour in the solution, and stirred occasionally, when it is taken out. dried in the shade, washed in clean water, and dried again. This preparation enables the cloth to repel water like the feathers of a duck's back, and yet allows the prespiration to pass somewhat freely through it, which is not the case with gutta-percha or india-rubber cloth.

The sulphate of lead is formed in this manner, and enters into the pores of the cloth. It is an insoluble salt; hence, the reason why it makes the cloth water-proof, while, at the same time, there is sufficient room in the interstices to allow the perspiration and heat from the body to escape.

Tweed cloth is light, and not expensive; it is also soft and pliable, and capable of being rolled up into small bulk without permanent wrinkles being formed in it. We have frequently prepared cloth in this manner, and have found it to answer an excellent purpose in rainy weather; while at the same time, in color and appearance, it does not differ from unprepared cloth.—*Scientific American.*

Corrosion of Lead in Water Pipes.

The following article, containing important information for a large class of the community, is from a late number of the Boston *Medical and Surgical Journal:*

"Mr. J. R. Nichols calls attention to a source of danger attending the use of leaden pipes used for the conveyance of drinking water, which seems to have been hitherto disregarded. Even if it be admitted that the water which is supplied to the city of Boston from Lake Cochituate, like that of most New England ponds, be such that it may be safely used after having passed through lead pipe under ordinary circumstances, it would nevertheless be wrong to infer that this water can be employed with entire safety at all points of delivery, without first inquiring whether special conditions may not exist in some localities by which the character of the water may there be changed. Having observed several instances in which the inmates of a single house had suffered from lead disease induced by the use of aqueduct water, while the inhabitants of other parts of the city, supplied with water from the same original source, were unaffected, and having in one instance detected the presence of considerable quantities of lead in one of the cases first mentioned, while no reaction for lead could be obtained from a specimen of the same aqueduct water taken from another locality, the author proceeded to inquire into the cause which produces this lead impregnation in certain houses or districts, while the general waters of a supply remain unaffected. He has noticed in the leaden pipes removed from cess-pools, sinks and wells, that the intensity of corrosive action had been in a great measure confined to the sharpest bends and depressions in the pipe, while in some instances other portions remained intact. "I have in my possession," he says, "a section of supply pipe, removed from the aqueduct of a neighboring city, in a portion of which corrosive action had proceeded so far as to cause leakage. The part thus acted upon was confined to an acute angle, and there is evidence to show that the plumber, in placing it in position, bent it in the wrong direction, thus creating the necessity for another turn in the opposite. This pipe had doubtless been subjected to two violent turns, which seriously impaired the homogeneity of the metal. An examination of lead pipe removed from buildings will certainly show that where there has been any perceptible amount of decomposition, it has been confided to the angles and depressions in its course There are three causes or agencies which may perhaps be sufficient to produce these results:—1. The disturbance in the crystalline structure of the metal by bending, whereby its electrical condition is changed and voltaic action promoted, giving rise to chemical decomposition. [Together with the galvanic action which must be induced wherever connections or faucets of copper, or alloy, are fastened to the leaden pipe, or where a crack or fissure in the latter has been filled with solder.] 2. The presence of organic matter, such as fragments of leaves, and impurities pervading pervading all pond waters, and which may be detained in angles and depressions of the pipes. 3. Corrosions may be produced in lead pipes by the accidental presence of pieces of mortar. Where mortar is present, the lime would assist in oxydizing the metal, and also aid in the solution of the oxyd. Considerable portions of fresh mortar are frequently deposited in lead pipes, during the erections of buildings. When the family commence the use of the water, it holds the salts of lead in solution, and its presence may be detected for months. The process of oxydation, which is retarded or prevented altogether by the presence of neutral salts in water, could not be materially interfered with under the conditions considered. It is obvious, if these observations and conclusions are correct, that much care should be exercised in placing pipes in position in buildings. In those leading to the culinary department, angles and depressions should be avoided. Violent twists and turns should not be permitted, and during the erection of houses, the open ends of protruding pipes should be carefully closed. Assuming the general fact that pipes, conveying the waters of our New England ponds become coated and protected by an insoluble lead salt, the question arises, how long before this protection is secured, or, how soon may a family commence the use of water passing through new pipes, with safety? In view of the manifest danger from local disturbances, the most sensible reply would be, never. A section of new lead pipe, immersed in Cochituate water one hour, at a temperature of 65° Fah., gave a decided lead reaction with sulphydric acid. Removed and placed in six fresh portions of water one hour each, the waters, when tested, give similar results. The experiment continued during two weeks. Varying the time of immersion in fresh portions of water from one to ten hours the lead indications continued, although at last feeble. These results are sufficient to show that individuals or families should not commence the use of water flowing through new pipes, until considerable time has elapsed, and much water contact secured."

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of LOCAL INDUSTRY, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

THE JOURNAL
OF THE
Board of Arts and Manufactures,
FOR UPPER CANADA.

SEPTEMBER, 1861.

DECORATIVE PAINTING.

Mural decoration is a subject not yet well understood by our modern house painters. There is evidently a growing desire in the public mind that our principal edifices should exhibit internally a fair proportion of the embellishment hitherto lavished on the exterior. Public buildings of the first class, including our Law Courts, Universities, and Civic Halls, while rivalling in exterior grandeur many similar buildings in Europe, are woefully destitute of internal beauty, and differ but little in this respect from our commonest buildings. The solution of this anomaly is no doubt to be found in the want of skill in the art of decorative painting, the legitimate and most appropriate species of embellishment for walls and ceilings.

Some laudable attempts have, it is true, been made to supply this defect by a species of mural painting, introduced by some German painters, commonly, but falsely, called fresco painting. The specimens we have seen executed in Toronto, and elsewhere are not such as would lead us to believe would be adopted by the originators of our really good buildings, since the art aims at nothing higher than an imitation of architectural details.

Fresco painting, as practised by the ancients, and still followed by many eminent artists, consists in colouring the plaster while FRESH, that is, before it becomes dry on the wall. The paintings thus produced are of a more permanent, and durable nature than ordinary paintings on other substances. The remains of ancient frescoes are found to retain their brilliancy of colour after the lapse of many centuries.

The so-called fresco painting, which has been practised to some extent in many of the public buildings in the province, has neither durability or good taste to commend it, and therefore the former is not so much to be regretted. But it is deplorable that, with the talent for drawing evinced by the perpetrators of this species of disfiguration, there should be so little taste in the choice of subject. The true aim of painting is to copy nature, and the truer it is to its object, the more pleasing it is to its admirers. Thus natural objects, whether animal or vegetable, will always be more interesting in a picture than representations of architectural, or similar productions of art. The decoration of walls and ceilings with architraves, pillars, and mouldings is not the legitimate work of the painter, but of the sculptor, whether he works in plaster, wood, or stone. If we require to supplement the poverty of the architecture in the interior of our buildings by painted shams, may we not apply the same rule to the exterior of our plainer edifices, and paint imitation colonnades and rich entablatures, where we cannot afford a more substantial material. Is not the idea absurd, but wherein consists the difference? Can we endure within what would not be tolerated without? Yet how few we find give themselves the trouble, for it requires no great education of the taste, to discriminate in a subject of this nature what is really good, or even barely tolerable, from what is absolutely worthless.

The subject of decorative painting has not yet received that degree of attention which its importance merits. It has not kept pace with the other branches of art which the recent revival of architecture has so fully developed. The reason probably is that we have so few ancient examples, compared with the more enduring remains of its sister arts. The destruction throughout Europe, and particularly in England, at the Reformation, of almost every kind of work in Christian art in fresco, in wood, or in missals, has doubtless deprived us of many valuable examples of a species of decoration well adapted for our present wants. Unfortunately, too, the few relics of this art have been until recently almost inaccessable to any but the antiquarian, or are published in books so rare and expensive as to be beyond the means of the humble artist, while greater facilities have obtained in procuring the examples in the obsolete pagan styles of Greece and Rome. Consequently we have had no choice between the external graining of the house painter, and the heathen gods and goddesses of the decorative artist, except the drab coloured columns, capitals, and architraves of the Germans.

The attention which is now directed to this subject in England, and throughout Europe, by such artists as Digby Wyatt and others, and the facilities afforded by the improved process of chromolithography, have brought the study of the art within the reach of the poorest mechanic who may possess the faculty of drawing. If the method of illuminating were once understood by our common house-painters, by no greater exercise of talent than is now required to imitate the graining of wood, and the veining of marble, they could produce beautiful effects by the judicious combination of a few colours in simple patterns, at much less cost than that of graining, and in endless variety.

The illuminated style of decoration is not only applicable to plastered walls or ceilings, but to every kind of woodwork, and also to furniture. Mr. W says: "To woodwork illumination may be m

most fitting embellishment; and the application of a very little art will speedily be found to raise the varnished deal cabinet or book-case far above the majority of our standard 'institutions' in the way of heavy and expensive mahogany ones—in interest at least, if not in money value."

If our ordinary house-painters could be induced, through the Mechanics' Institutes or other means, to educate themselves in the art of illuminating, by beginning at first to copy from examples of ancient manuscripts or similar works, which can now be got at trifling cost, and having studied the true principles of polychromatic effects, we should soon see a vast improvement in the style of our house decoration.

What is the present style of the art? Suppose we should wish to spend a few dollars in the extra embellishment of our drawing-room, we send for the painter and ask his advice. "Have the walls grained oak," is the ready suggestion; and he adds, "If you wish a first-rate job, have it twice varnished." "But we are tired of oak; is there no other way?" "Oh, yes; there is satin wood and maple, but there is nothing stands like oak." So, if we should follow the advice of the painter, we are absolutely tied down to a base imitation of what we could as easily, and as cheaply obtain in its genuine state. Nor would we succeed much better with the architect. He would perhaps tell us, if he should happen to know, that there is a description of wall decoration, much admired in England, by which we could avoid the objectionable sham of graining; but that it would be impossible to attempt it in this country, unless we imported the workmen. Any attempt to introduce a superior style of decoration to that in use, we are fully assured, would result in failure, unless our painters, well qualified to execute the painting usually required, gave their attention to the subject.

INTERNATIONAL EXHIBITION OF 1862.

We had hoped to have been in a position to have announced in this number of the Journal, the appointment by His Excellency the Governor General, of a Provincial Commission to act on behalf of contributors to the International Exhibition of 1862.

Our readers are doubtless aware that the Boards of Arts and Manufactures for both Upper and Lower Canada, as well as the Boards of Agriculture, memorialized the Governor-in-Council during the last Session of Parliament to appoint such a Commission, and to make a grant of money for the purpose of aiding in securing a proper representation of the Arts, Manufactures, and Natural Products of Canada.

The Government did not see fit to recommend to Parliament any appropriation for this purpose, nor did the prayer of the memorialists for the appointment of a Commission meet with any better success; the consequence is, that Canada will be entirely unrepresented, unless this error on the part of the government is at once remedied by the appointment of a Commission, through whom alone private contributors can hold communication with Her Majesty's Commissioners, or enter articles for exhibition. This position of affairs is much to be regretted, as we are confident that an appropriation of money for this object would have met with the cordial approval of all parties; and as the Provincial Exhibitions are now about to be held, excellent opportunities would have been afforded for making suitable selections of articles for transmission home.

Memorials have again been presented by the above named Boards, with a view to induce the government to reconsider the matter of appointing a Provincial Commission.

The decisions of Her Majesty's Commissioners on the reception, classification, and charge of the goods sent for exhibition, appeared in the April No. of the Journal, but as the Commissioners have since made several amendments and additions thereto, we now publish them in full as amended.

Amended and Additional Decisions of Her Majesty's Commissioners on Points Relating to the Exhibition.

1. Her Majesty's Commissioners have fixed upon Thursday, the 1st day of May, 1862, for opening the Exhibition.

2. The exhibition building will be erected on a site adjoining the gardens of the Royal Horticultural Society, and in the immediate neighborhood of the ground occupied in 1851, on the occasion of the first International Exhibition.

3. The portion of the building to be devoted to the exhibition of Pictures will be erected in brick, and will occupy the entire front towards Cromwell-road; the portion in which machinery will be exhibited will extend along Prince Albert's-road, on the west side of the gardens.

4. All works of industry to be exhibited should have been produced since 1850. The decision whether goods, proposed to be exhibited, are admissible or not, must, in each case, eventually rest with Her Majesty's Commissioners.

5. Subject to the necessary limitation of space, all persons, whether designers, inventors, manufacturers, or producers of articles, will be allowed to exhibit; but they must state the character in which they do so.

6. Her Majesty's Commissioners will communicate with Foreign and Colonial exhibitors only through the Commission which the Government of each Foreign Country or Colony may appoint for that purpose; and no article will be admitted from any Foreign Country or Colony without the sanction of such Commission.

7. No rent will be charged to exhibitors.

8. Every article produced or obtained by human industry, whether of

Raw materials, machinery, manufactures or fine arts, will be admitted to the Exhibition, with the exception of

1. Living animals and plants.
2. Fresh vegetable and animal substances, liable to spoil by keeping.

3. Detonating or dangerous substances.

Copper caps, or other articles of a similar nature, may be exhibited, provided the detonating powder be not inserted; also Lucifer Matches, with imitation tops.

9. Spirits or alcohols, oils, acids, corrosive salts, and substances of a highly inflammable nature, will only be admitted by special written permission, and in well secured glass vessels.

10. The articles exhibited will be divided into the following classes:—

SECTION I.

Class 1. Mining, Metallurgy, and Mineral products.
" 2. Chemical Substances and Products, and Pharmaceutical Processes.
" 3. Substances used for food, including Wines.
" 4. Animal and Vegetable Substances used in Manufactures.

SECTION II.

Class 5. Railway Plant, including Locomotive Engines and Carriages.
" 6. Carriages not connected with Rail or Tram Roads.
" 7. Manufacturing Machines and Tools.
" 8. Machinery in general.
" 9. Agricultural and Horticultural Machines and Implements.
" 10. Civil Engineering, Architectural, and Building Contrivances.
" 11. Military Engineering, Armour and Accoutrements, Ordnance, and Small Arms.
" 12. Naval Architecture, Ship's Tackle.
" 13. Philosophical Instruments and Processes depending upon their use.
" 14. Photographic Apparatus and Photography.
" 15. Horological Instruments.
" 16. Musical Instruments.
" 17. Surgical Instruments and Appliances.

SECTION III.

Class 18. Cotton.
" 19. Flax and Hemp.
" 20. Silk and Velvet.
" 21. Woollen and Worsted, including Mixed Fabrics generally.
" 22. Carpets.
" 23. Woven, Spun, Felted, and Laid Fabrics, when shown as specimens of Printing or Dyeing.
" 24. Tapestry, Lace, and Embroidery.
" 25. Skins, Fur, Feathers, and Hair.
" 26. Leather, including Saddlery and Harness.
" 27. Articles of Clothing.
" 28. Paper, Stationery, Printing, and Bookbinding.
" 29. Educational Works and Appliances.
" 30. Furniture and Upholstery, including Paper-hangings, and Papier-mache.
" 31. Iron and General Hardware.
" 32. Steel and Cutlery.
" 33. Works in Precious Metals, and their imitations, and Jewellery.
" 34. Glass.
" 35. Pottery.
" 36. Manufactures not included in previous classes.

SECTION IV.—MODERN FINE ARTS.

(*See Decisions* 111–123.)

Class 37. Architecture.
" 38. Paintings in Oil and Water Colors, and Drawings.
" 39. Sculpture, Models, Die-sinking, and Intaglios.
" 40. Etchings and Engravings.

11. Prizes, or rewards for merit, in the form of medals, will be given in Sections I. II. III.

12. Prices may be affixed to the articles exhibited in Sections I. II. III.

13. Her Majesty's Commissioners will be prepared to receive all articles which may be sent to them, on or after Wednesday the 12th of February, and will continue to receive goods until Monday, the 31st of March, 1862, inclusive.

14. Articles of great size or weight, the placing of which will require considerable labor, must be sent before Saturday, the 1st of March, 1862; and manufacturers wishing to exhibit machinery, or other objects, that will require foundations or special constructions, must make a declaration to that effect on their demands for space.

15. Any exhibitor whose goods can be properly placed together, will be allowed to arrange such goods in his own way, provided his arrangement is compatible with the general scheme of the Exhibition and the convenience of other exhibitors.

16. Where it is desired to exhibit processes of manufacture, a sufficient number of articles, however dissimilar, will be admitted for the purpose of illustrating the process; but they must not exceed the number actually required. (17–25.)*

26. Exhibitors will be required to deliver their goods at such part of the building as shall be indicated to them, with the freight, carriage, porterage, and all charges and dues upon them paid.

27. The vans will be unloaded, and the articles and packages taken to the places appointed in the building, by the officers of Her Majesty's Commissioners.

28. Upon receipt of notice from Her Majesty's Commissioners, that the articles are deposited in the building, exhibitors, or their representatives, or agents, must themselves unpack, put together, and arrange their goods.

29. Packing cases must be removed at the cost of the exhibitors or their agents, as soon as their goods are examined and deposited in charge of the Commissioners. If not removed within three days of notice being given, they will be disposed of, and the proceeds, if any, applied to the funds of the Exhibition. (30—34.)*

35. No counters, or fittings, will be provided by Her Majesty's Commissioners. Exhibitors will be permitted subject only to the necessary general regulations, to erect, according to their own taste, all the counters, stands, glass frames, brackets, awnings, hangings, or similar contrivances which they may consider best calculated for the display of their goods.

36. Exhibitors, or their representatives, should provide whatever light temporary covering may be requisite (such as sheets of oiled calico,) to protect their goods from dust; and, in the case of machinery, and polished goods, should make the requisite arrangements for keeping the articles free from rust during the time of the Exhibition. (37—42.)*

43 Exhibitors must be at the charge of insuring their own goods, should they desire this security. Every precaution will be taken to prevent fire, theft, or other losses, and Her Majesty's Commissioners will give all the aid in their power for the legal prosecution of any persons guilty of robbery, or wilful injury in the Exhibition, but they will not be responsible for losses or damages of any kind which may be occasioned by fire or theft, or in any other manner.

44. Exhibitors may employ assistants (male or female) to keep in order the articles they exhibit, or to explain them to visitors, after obtaining written permission from Her Majesty's Commissioners; but such assistants will be forbidden to invite visitors to purchase the goods of their employers. (45—49.)*

50. Articles once deposited in the Building will not be permitted to be removed without written permission from Her Majesty's Commissioners. (51—54.*)

* Several numbers marked thus (*) in this and the following page are left blank, with the view of incorporating future decisions.

55. Her Majesty's Commissioners will provide shafting, steam (not exceeding 30 lbs. per inch), and water, at high pressure, for machines in motion.

56. Persons who may wish to exhibit Machines, or trains of Machinery, in motion, will be allowed to have them worked, as far as practicable, under their own superintendence, and by their own men. (57—70.*

70. Intending exhibitors, in the United Kingdom, are requested to apply, without delay, to the Secretary of Her Majesty's Commissioners, for a *Form of Demand for Space*, stating at the same time in which of the four Sections they wish to exhibit.

71. The following is the form which has to be filled up:—

1. Name and Christian name of applicant (or name of firm)
2. Nature of business carried on.
3. Address — No. of street or square, &c. and Name of Town
4. Nature of articles to be exhibited
5. Number of class in which they are to be exhibited.

	Floor Space.	
6. Probable Space that will be required for articles or case in which they will be shown	Length...	feet
	Breadth...	feet
	Heighth...	feet
	Hanging or Wall Space.	
	Height...	feet
	Width...	feet

100. Foreign and Colonial exhibitors should apply to the Commission, or other Central Authority appointed by the Foreign or Colonial Government, as soon as notice has been given of its appointment.

101. Her Majesty's Commissioners will consider that to be the Central Authority in each case which is stated to be so by the Government of its country, and will only communicate with Exhibitors through such Central Body.

102. No articles of foreign manufacture, to whomsoever they may belong, or wheresoever they may be, can be admitted for exhibition, *except with the sanction of the Central Authority of the country of which they are the produce.* Her Majesty's Commissioners will communicate to such Central Authority the Amount of space which can be allowed to the productions of the country for which it acts, and will also state the further conditions and limitations which may from time to time be decided on with respect to the admission of articles. All articles forwarded by such Central Authority will be admitted, provided they do not require a greater aggregate amount of space than that assigned to the county from which they come; and, provided also, that they do not violate the general conditions and limitations. It will rest with the Central Authority in each country to decide upon the merits of the several articles presented for exhibition, and to take care that those which are sent are such as fairly represent the industry of their fellow-countrymen.

103 Separate space will be allotted to each foreign country, within which the Commissioners for that country will be at liberty to arrange the productions entrusted to them in such manner as they think best, subject to the conditon that all machinery shall be exhibited in the portion of the building specially devoted to that purpose, and all pictures in the fine art galleries, and to the observance of any general rules that may be laid down by her Majesty's Commissioners for public convenience.

104. By arrangements made with Her Majesty's Government, all Foreign or Colonial goods intended for exhibition, sent and addressed in accordance with regulations hereafter to be issued, will be admitted into the country, and transmitted to the Exhibition building without being previously opened, and without payment of any duty; but all goods which shall not be re-exported at the termination of the Exhibition will be charged with the proper duties, under the ordinary Custom's Regulations. (105—108.)*

109. It is not the intention of her Majesty's Commissioners to take any steps in reference to the protection of inventions or designs, by patent or registration, the law on these points having been materially simplified since 1851.

Decisions Specially Applicable to Section IV.—Modern Fine Arts.

Class 37. Architecture.
" 38. Paintings in Oil and Water Colours and Drawings.
" 39. Sculpture Models, Die-sinking and Intaglios.
" 40. Engravings and Etchings.

110. The object of the Exhibition being to illustrate the progress and present condition of *Modern Art*, each country will decide the period of Art which in its own case will best attain that end.

111. The Exhibition of British Art in this Section will include the works of artists alive on or subsequent to the 1st of May, 1762.

112. It is not proposed to award Prizes in this Section.

113. Prices will be not allowed to be affixed to any Work of Art exhibited in this Section.

114. One-half of the space to be allotted to Section IV. will be given to Foreign Countries, and one-half will be reserved for the works of British and Colonial Artists.

115. The subdivision of the space allotted to Foreign Countries will be made, after consideration of the demands received from the Commission, or other Central Authority of each Foreign Country. It is, therefore, important that these demands should be transmitted to Her Majesty's Commissioners at the earliest possible date.

116. The arrangement of the Works of Art within the space allotted to each Foreign Country will be entirely under the control of the accredited representatives of that country, subject only to the necessary general regulations.

117. For the purposes of the Catalogue, it will be necessary that the Central Authority of each Foreign Country should furnish Her Majesty's Commissioners, on or before the 1st of January, 1862, with a description of the several Works of Art which will be sent for exhibition, specifying in each case, the name of the artist, the title of the work, and (when possible) the date of its production.

118. The space at the disposal of Her Majesty's Commissioners for the display of British Art being limited, and it being at the same time desirable to bring together as careful and perfect an illustration as possible, a selection of the works to be exhibited will be indispensable.

119. The selection of Exhibitors, the space and number of works to be allowed to each, and the arrangement of them, will be entrusted to Committees to be nominated by Her Majesty's Commissioners.

120. In the case of living artists, her Majesty's Commissioners would desire to consult the wishes of the artists themselves as to the particular works by which they would prefer to be represented. The selection of works so made by the artists will not necessarily be binding on her Majesty's Commissioners, but in no case will any work by a living artist be exhibited against his wish, if expressed in writing, and delivered to the Commissioners on or before the 31st of March, 1862.

121. Her Majesty's Commissioners will avail themselves of the following eight Art Institutions of this country in communicating with artists who are members of those institutions, viz.:—

The Royal Academy.
The Royal Scottish Academy.
The Royal Hibernian Academy.
The Society of Painters in Water Colours.
The Society of British Artists.
The New Society of Painters in Water Colours.
The Institute of British Artists.
The Institute of British Architects.

122. Intending Exhibitors in the British Division of Section IV., who are not members of any of the preceding Institutions, may at once receive Forms of Demand for Space, by applying to the Secretary to Her Majesty's Commissioners. These Forms must be filled up and returned before the 1st of June, 1861.

By Order. F. R. Sandford, *Secretary*.

Offices of Her Majesty's Commissioners, 454, West Strand, London, W.C.

THE PROVINCIAL EXHIBITION OF 1861.

It is unnecessary to expatiate upon the growing importance of our Annual Provincial Exhibitions. The results to which they have led speak for themselves, and everywhere in the older parts of the country afford ample proof of the advantages they are capable of conferring, especially in the part of Canada where they may be held.

This is shown better in Agriculture than in Manufactures, and in the Agricultural rather than in the Manufacturing departments of our Exhibitions, because from the force of circumstances the field more than the workshop has hitherto been the scene of industry. Since, however, we became an established and prosperous country, this proportional difference has diminished; Arts and Manufactures have grown into great importance, pressing themselves upon the attention of the public and seeking encouragement by invoking a patriotic feeling in favour of home manufactures and home industry of every description, until their growth and development have become matters of national interest.

Compare the map of settled Canada ten years ago with what it is now; glance at the new townships which have sprung up in the West, North-west, and far East, and it will be seen that a tract of country equal in area to a moderate sized European Kingdom has been in part won from the wilderness and settled—an area nearly as large as the whole peopled part of Canada previously to the last census.

There is the Valley of the Saugeen and part of the Valley of the Maitland on Lake Huron; the Valley of the Nottawasaga on Georgian Bay; the back country stretching from Lake Simcoe to the Rideau; the Valley of the Upper Ottawa, of the St. Maurice and other rivers in Lower Canada, and of various tributaries to the Great St. Lawrence on both the North and South side as far as Gaspé.

The natural productions of the country, utilized by industry and Art are increasing in number and quantity. One of the most recent is the Petroleum of the West, which promises, as recent discoveries show, to become a very important product. The mines of Copper in Lower Canada have only been heard of within the last two years, and are already both valuable and promising. Different varieties of timber, that great natural staple of the country, formerly allowed to rot on the ground or burned to get them out of the way, are now articles of export. Apart from all these considerations is the fact that the population of the country has assumed a stability and steadiness of increase which is astonishing when we survey the condition of the country during and since the memorable year 1857.

In no way, however, may an impartial observer note the true progress of the country than by witnessing and comparing our Annual Provincial Exhibitions. This is particularly observable in the Agricultural Department, not on account of greater energy, skill or enterprise having been given to this branch of our industry, but because it has hitherto occupied much of the capital and attention of the great mass of the people. But the time is rapidly approaching, if it has not already arrived, in which we shall see a similar progress in Arts and Manufactures throughout the older settled parts of the country. It would be absurd to look for equal results as far as quantity and variety is concerned, as we are essentially an agricultural people—particularly in the West where the next Exhibition is to be held—confining ourselves in the field of Manufacturing Industry to those articles which are most in demand and susceptible of practical application to every day uses, and which cannot be so cheaply produced in other countries. There are numberless items, however, which come, so to speak, from abroad, but which ought to be manufactured at home. No one requires to be told that the more home industry is encouraged in all its branches, the more prosperous and the more independent is the country likely to become under ordinary circumstances, and many are convinced that it is only necessary to bring our manufactures before the public in a prominent and attractive form, in order to secure, first, attention, and then very general patronage.

At the best it is a fleeting and very imperfect impression of our works of skill, or industry and art, which a crowd of excited observers rapidly streaming past, is capable of obtaining at our Annual Exhibitions. There is neither time nor space for a careful examination or even for a favourable display. All Canadian Manufactures in a Canadian Exhibition should be represented and exposed to view, when they will admit of it, in such a manner as to show their qualities and character, besides affording information respecting their cost and the facilities for supply. A Provincial Exhibition, lasting only four days, does not afford the facilities which are sought,

but for the present they are the best at our command and should be embraced to the utmost extent of which they are susceptible.

It was one of the lessons taught by the magnificent displays at London and Paris, that selection and arrangement are the mainsprings of success in displaying the products, natural or artificial, of any district. It has been hoped by many who have turned their attention to this subject that the approaching Exhibition at London, Canada, would afford an opportunity for commencing a collection of articles fitted to represent Canadian Industry at London, England, in 1862. We still indulge the hope that this may yet be the case, although more than an usual dependence on individual zeal and patriotism may be involved.

It is only during the past year that the Board of Arts and Manufactures have been in a position to fulfill a portion of the duties imposed on them by law; but having made a beginning, it is probable that more extended and practical efforts will soon be made. Our readers are already aware of the efforts of the Boards for Upper and Lower Canada to procure government assistance in securing a complete representation of Canadian Industry at London next year. The result has been most unfortunate, and we are left to rely on private resources and energy in collecting and contributing materials for exhibition. This is not the time or place to discuss the wisdom of so much self-reliance in an arena where all are so strong, and many infinitely stronger than Canada; nevertheless, it has one obviously good effect, namely, if it does not stimulate a ficticious and temporary industry as many think it would, it will show what Canadians can accomplish by individual and unassisted efforts. Our first field for display is at home, it will then be time to form a judgment whether we shall be able to retain laurels already won, or add another wreath to those we continue to call our own.

The approach of the next Exhibition suggests a few reflections which may yet assume a tangible form. Our mineral wealth, for instance, is so distributed and is of such a character, that the position of Canada as a mineral producing country, is already known, and our main hope lies in the application we may make at home of the mineral wealth of the country. At future Provincial Exhibitions would it not be well to have a mineral department, under the supervision of the Board of Arts and Manufactures, in order to familiarize the people with the more common forms in which the crude products of the country occur. Most of our new townships and newer settlements are made and indeed must be made, on rocks whose mineral character is pretty well known, and it is time that those who occupy them should have an opportunity of becoming familiar with the ordinary aspects of the minerals of the country. This could be easily accomplished by encouraging the exhibitions of specimens of the more important minerals, the name, locality, and probable distribution being faithfully given.

It was remarked in Europe when the forest trees were collected from all parts of the world and displayed at Paris and London, that many species common in North America were admirably adapted for different manufacturing purposes, and would command high prices if brought into market. Why not carry out the idea in Canada, and by having an annual display of our forest productions accustom the people to them and acquaint them with their properties and uses. By adopting a strict culling process and by paying the cost of each contribution, a Museum of natural products, both mineral, vegetable, and even animal, might rapidly be formed at each permanent Exhibition Building, from which a selection for the central Museum of the Board of Arts and Manufactures could be made as opportunity offered.

PROVINCIAL EXHIBITION BUILDINGS AND GROUNDS.

While on a visit to the pleasant little City of London during the past month, in company with some members of the Board of Agriculture, we proceeded to the Exhibition Grounds, and took a run through the Building just erected by the energetic local committee of that city, for the purposes of the Provincial Exhibition, which is to commence on Tuesday, the 24th instant.

The grounds are enclosed by a close board fence, 8 feet high. On the north side of the grounds, and within the enclosure, is a small Lake, covering an area of about 5 acres, which will be very convenient for the watering of cattle, and for other purposes.

The extent of the Sheds now being erected for the accommodation of Cattle, Machinery, &c., will be upwards of 3,000 feet in length.

The building is erected in the immediate vicinity of the Barracks, and within half a mile of the centre of the city, on a beautiful piece of ground of about 26 acres, a portion of which has been purchased from the Government by the Corporation, for this purpose.

The ground plan of the building is a regular octagon, its dimensions from opposite angles being 186 feet. The space offered by the ground area is upwards of 24,000 feet, while the galleries give an additional space of 4,000 feet more. The external wall is built of white brick, on a foundation of rubble masonry and concrete, and is twenty-one feet in height. The entrance to the building is through eight doorways, each eight feet wide and fourteen feet high, one at each angle. In the brick wall, on

each side of the octagon and between the doorways, are five spacious windows, making on the ground floor forty windows. The roof of this portion of the structure is covered with felting, gravel, &c. The arrangement of the doors will afford ready ingress and egress to the building, besides securing a thorough draft for the purposes of ventilation. The second tier of the building, containing the gallery, rises to the height of thirty-two feet above the ground line, and is 114 feet in diameter from opposite angles, giving a wall accommodation of more than 300 feet, lighted with forty-eight windows, every alternate one being hung on a pivot to admit of ventilation. The ascent and descent to the upper portion of the building is provided for by two stairways, one being intended for the entrance and the other for the exit of the public, and leading in opposite directions, so as to divide the crowd. The third tier of the building is a continuation of the inside gallery wall, and runs to the height of forty feet above the ground line. This tier supports the cupola, and is covered with a shingle roof. The interior view is clear, and not interrupted by any timbers to the height of eighty-seven feet. The full height of the building, to the top of the flag-staff, is 114 feet; the dimensions of the cupola, twenty feet diameter by thirty-one in height; area of the ground floor and gallery 28,000 feet, being about the same area as the Hamilton Exhibition Building and 4,000 feet less than the Toronto Building. The sheeting of the roof is painted a blue colour, the timbers a drab. Provision is made for a band of music in a suitable situation. The building is designed and constructed with a view to the purposes for which it is erected, and also with a due regard to economy. The architect, a citizen of London, has been happy in designing and completing a building well adapted for the purposes of the Exhibition, and that, too, at a cost under $9,000. The building is of the most permanent character, the best stone, brick and lumber, being used in its construction; while the workmanship is of a superior order. Mr. Alexander Campbell was the contractor, and by his exertions has succeeded in having it finished several weeks before the contract time. On the whole, it may be said that the London Exhibition Building is a credit to the architect, the contractor, and the local committee who have shown so much energy in pushing it to its early completion.

The interior fittings, which have also been contracted for by Mr. Campbell, will be ready some time before the Exhibition commences.

Messrs. J. & S. Blackburn, proprietors of the London *Daily Free Press*, have at considerable expense published a large woodcut illustration of the building, from designs by the Architect, W. Robinson, Esq., of which we have secured a sufficient number of copies for presentation with this number of the Journal.

BRITISH AMERICA AND THE INTERNATIONAL EXHIBITION OF 1862.

The New Brunswick Provincial Board of Agriculture has applied for the large area of 20,000 feet to be allotted for the use of the Province, as the probable space required for the exhibition of its Arts, Manufactures, and Natural Products, together with a wall surface of 300 feet.

Nova Scotia intends to make a good display of her Manufactures and Natural Products; amongst the latter will be specimens of her recent gold discoveries, and some beautiful specimens of Jewellery made therefrom for Lady Mulgrave. His Excellency, in a recent dispatch, informs the Duke of Newcastle that "No exertion will be wanting on his part for furthering this important object" of having Nova Scotia duly represented.

Prince Edward Island is making every exertion to secure a good representation of her products at the Exhibition; and intends to furnish not only the Staple Produce of the Island, but specimens of the best Woollen Manufactures, and Furniture made in the Colony from the native woods, &c., &c.

In the Island of Vancouver,

"At a meeting of the General Committee appointed to take steps to have the resources of the British Colonies of the Pacific represented at the Great Exhibition of 1862, the following resolutions were adopted unanimously:—

"That every member of the committee should pay the sum of $1 per month subscription.

"The sum of $250 to be appropriated for the best pamphlet to be written on the resources of British Columbia and Vancouver Island.

"A further sum of $750 was voted for the expense of printing the said pamphlet.

"$5,000 was granted to defray the expenses of the committee for collecting specimens, &c.

"The Executive Committee of the Industrial Exhibition invite attention to the subjoined list of articles, crude and manufactured, specimens of which they deem desirable for transmission to England, to represent the industrial resources of these colonies at the Great Industrial Exhibition in 1862. The committee trust to see specimens of Colonial Produce, which, with care in their preparation, may enter into competition with similar articles of European or other colonial prodnction, with a fair chance of winning, if not a premium, at all events that commendation from the gathering of all nations at the Great International Exhibition, which would tend more than any other means to direct the attention of emigrants towards these colonies.

"Two methods of obtaining collections will be adopted:—

"1st. Specimens contributed to or purchased by the association.

"2nd. Specimens lent to the association, of which due care will be taken, and which will be returned to the owner or disposed of to the best advantage in England. All articles will be labelled with the name and address of the donor or lender, and will be conveyed to England in the same state as sent to the association here, who will bear the expense of their transmission."

Lists of articles that may be contributed from Vancouver Island, and British Columbia, are suggested, under the following heads, viz:—Agriculture, Fish, Wood, Stone, Minerals, Fabrics, Miscellaneous, and articles illustrating Indian handicraft.

The Hudson Bay Company will no doubt see that the Skins and Furs of Animals are duly represented.

Canada, the wealthiest, and best able of all the American Colonies to make a creditable show, is doing nothing; the Farmers, Mechanics & Artizans are not only willing but anxious to have an opportunity of exhibiting their various productions, but as the Provincial Government has not yet appointed any Central Authority, through whom alone intending Exhibitors can communicate with Her Majesty's Commissioners, their efforts to do so would be useless.

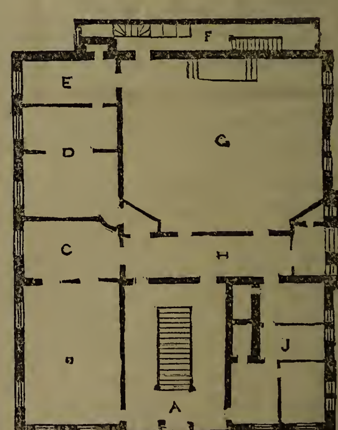
THE TORONTO MECHANICS' INSTITUTE.

The above woodcut is a south-west view of the New Hall of the Toronto Mechanics' Institute, in which the Board of Arts and Manufactures have lately established their Rooms. It stands on the south-east corner of Church and Adelaide streets, and is a large, commodious, and really imposing building, 104 feet by 80 feet, designed in the Italian style by Messrs. Cumberland & Storm, architects; and will cost, when fully completed, with the ground it stands on, about $48,000.

At the time of its enclosure, it was leased to the Government for Departmental offices, and used as such until their removal to Quebec; the Institute meanwhile occupying their old quarters. Nothing was done to the new building in the way of fitting it up for its original purposes, until the beginning of the present year, owing to protracted negotiation with the Government.

The extensive alterations necessary to adapt it to its present uses are nearly finished, and for completeness and accommodation it is not equalled by any building of the kind in Canada.

The basement contains four class-rooms, housekeeper's apartments, water closets, &c., and three very large fuel and storage vaults, and kitchen for the use of the supper room.

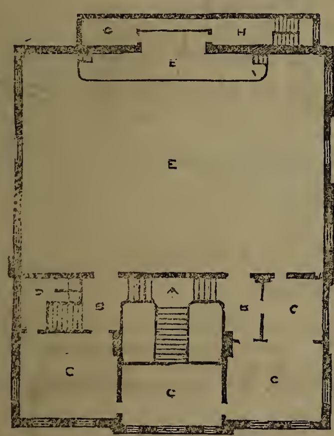


GROUND PLAN.

The ground floor, as will be seen by a reference to the plan, has two large entrances. The entrance hall from Church-street is 36 feet by 25 feet, and contains the principal staircase to the Music Hall and upper floor. The walls are finished with pannelled dado, pilaster columns, and rich modillion cornice, in the Corinthian order. The stairs are wide and bold, a centre ¾ flight, with niche for figure at head,

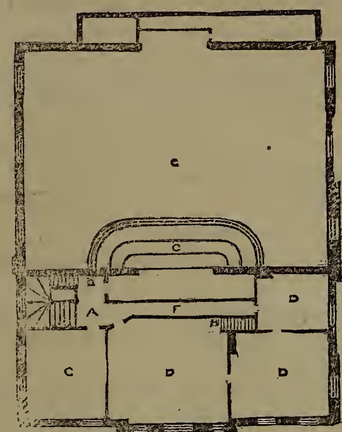
and branching off at either side to entrance of Music Hall.

To the left are the Reading Rooms (B and C), each 35+24 feet and 24+15 feet, fitted up in the most comfortable and convenient manner, and well supplied with newspapers and other publications. The Library (D), 28+24 feet, contains about five thousand volumes. Both Library and Reading Rooms are expensively fitted up with oak. Completing this suite of rooms is the Board Room, containing also a collection of valuable philosophical apparatus. The Lecture Room (G) is 51+42 feet, and is intended for the ordinary lectures of the Institute, and to be used as a supper room in connection with the Music Hall, and will also be open for rental for other purposes. The rooms marked J are leased at present to Messrs. Roaf and Davis, as law offices.



FIRST FLOOR

By a reference to plan No. 2, it will be seen that the Music Hall (E) occupies the greater portion of this floor, and also the whole height of this and the upper story. Its total dimensions are 76+53 feet; height of ceiling, 36 feet. In the centre of the east side is an arched organ recess, under an enriched entablature, supported by ¾ Corinthian columns of imitation Sienna marble. The soffits and imposts of the arch are highly ornamented in plaster. In front of this recess stands the performers' platform, 40 feet long by 10 feet wide. On the opposite side of the room a very rich gallery projects from the wall, supported on ornamented iron columns. The room is lighted by three large windows at each end. The ceiling springs from a modillion cornice, and is coved with a large domical centre panel, and rich, handsome centre ornaments. The walls and ceiling of this room, together with main entrance hall, are being decorated at a cost of $1,200, and it is expected when finished to present an exceedingly rich and chaste appearance. Behind the platform is a performers' retiring room, to which access is obtained by a private entrance from Adelaide-street (F). The rest of this floor is occupied by a suite of dressing and refreshment rooms (C C C C), fitted with suitable conveniences.



SECOND FLOOR

A stair, 6 feet wide, leads to the second floor, three rooms of which (D D D) are occupied by the Board of Arts and Manufactures as Model Room, Board Room and Free Library of Reference, and Secretary's Office. Room C is intended for a Chess Club, and also for use as a gentlemen's hat and cloak room in connection with the Music Hall. The entrance to the gallery of the Music Hall (G) is from this floor.

Over the passage (F), and extending the whole width of the building, is a Model Gallery, 76+14 feet, also occupied by the Board of Arts and Manufactures, and approached by a stair from the Model Room, and lighted by two large skylights from the roof.

The subject of heating the building (a very important one, and a subject on which much difference of opinion exists), whether by steam or heated air, is now under consideration, and will be proceeded with as early as possible.

The membership of the Institute is daily increasing, and no wonder that it should be so, considering that the whole of its advantages may be secured for the trifling sum of $2 per annum, and to ladies $1.50.

EDITORIAL NOTICES.

In consequence of unexpected delays in procuring some of the woodcuts, the present number is issued a few days behind time. We will endeavour to prevent a similar occurrence for the future.

BOARD OF ARTS AND MANUFACTURES FOR UPPER CANADA.

Notice.

The regular Quarterly Meeting of the Board will be held on Tuesday the 1st of October, at the Board Rooms, Mechanics' Institute, Toronto, at two o'clock P. M.

WM. EDWARDS,
Secretary.

PRIZE ESSAY.

Owing to the absence from the City of two of the gentlemen appointed as Judges of "Essays on the Manufactures of Canada," no Report has yet been received on the Essays competing for the Prizes offered by the Board; it will however be prepared in time for publication in the next number of the Journal.

CLASSIFIED CATALOGUE OF THE FREE LIBRARY OF REFERENCE.

INDEX.

1. Alphabets, Writing, &c.
2. Antiquities.
3. Architecture and Building.
4. Biography of Artists, Engineers, Inventors, Manufacturers, &c.
5. Catalogues of Books, Apparatus, Manufactures, &c.
6. Decoration and Ornament, and Designing not embraced in Class 3.
7. Dictionaries, Directories, Encyclopedias, &c.
8. Drawing and Geometry.
9. Engineering and Mechanics.
10. Fine Arts.
11. Geography, Topography and Statistics.
12. Geology, Metallurgy, Mines and Mining.
13. Horticulture, Agriculture and Rural Affairs.
14. Manufactures, Trades, and Industrial Arts in General.
15. Miscellaneous, and Works treating on subjects in more than one department of the Library.
16. Natural History, General.
17. Naval Architecture.
18. Patents of Inventions and Designs.
19. Parliamentary and Municipal Publications.
20. Periodicals.
21. Science, General.
22. Transactions of Societies.

CATALOGUE.

1.—ALPHABETS, WRITING, &c.

Ornamental Alphabets, 24 sheets..
" " 6 " ....
Penman's Manual; a New Theory and System of Practical Penmanship; 4to; 1861............
Universal Decorator; 3 vols., 4to; 1858–'59–'60 .... *Thompson.*

2.—ANTIQUITIES.

Archæology and Prehistoric Annals of Scotland; 8vo; 1851 .... *Daniel Wilson.*
Antique Vases, Altars, Candelabras, &c.; 170 plates; 4to; 1814 .... *Moses.*
Costume of the Ancients; 321 plates; 2 vols., 8vo; 1841.. *Hope.*
History of Ancient Pottery, Egyptian, Assyrian and Greek; numerous colored plates and engravings; 2 vols., 8vo; 1858.. *Birch.*
History of Pottery and Porcelain, Mediæval and Modern; colored plates; 8vo; 1857.......... *Marryat.*
Vases from the Collection of Sir H. Englefield; 51 plates; 4to; 1848............................ *Moses.*

3.—ARCHITECTURE AND BUILDING.

Architectural History of Canterbury Cathedral; 8vo; 1845.. *Willis.*
Application of Cast and Wrought Iron to Building Purposes; 8vo; 1854........................ *Fairbairn.*
Beauties of Modern Architecture; numerous plates; 8vo; 1839...................................... *Lafever.*
Constructive Architecture: a Guide to the Builder and Mechanic, with a series of Designs and choice Examples of the five Orders of Architecture; folio; 1859.......................... *Sloan.*
Carpenter and Joiner's Assistant, with an illustrated Glossary of Terms used in Architecture and Building; fol.; 1860.. *Newlands.*
Church, Parsonage and School Architecture; 8vo; 1856.. *Dwyer.*
Church of Great Haseley, Oxfordshire; 8vo; 1848.. "
Carpenter's New Guide, a complete book of Lines for Carpentry and Joinery; 8vo; 1856... *Sloan.*
Domestic Architecture; being a series of Designs for Mansions, Villas, Parsonages, Lodges, &c. &c.; 2 vols., fol.; 1850.. *Goodwin.*
Encyclopedia of Architecture, Nicholson's; 2 vols., 4to.. *Lomax & Gunyon.*
Encyclopedia of Cottage, Farm and Villa Architecture, and Furniture; 2000 illustrations; 8vo; 1853.. *Loudon.*
Gothic Architecture applied to Modern Residences, with elaborate Drawings and copious details; 4to; 1851 .... *Arnot.*

Hints on Public Architecture, with Views and Plans of the Smithsonian Institute, and an Appendix on Building Materials; fol.; 1849 .... *Owen.*
Mechanic's and Builder's Price Book, with Dictionary of Mechanical Terms, &c.; 8vo; 1859 *Wilson.*
Mechanical Principles of Engineering and Architecture; 8vo; 1856 .... *Moseley.*
Stair Building and Hand Railing; illustrated by 8 large engravings; folio .... *O'Neill.*
Treatise on the Five Orders of Architecture, and on Gothic Architecture, with numerous Illustrations; folio; 1853 ....
The Architect, or Practical House Carpenter; illustrated by 64 engravings; 4to .... *Benjamin.*
The American Stair Builder, containing a complete exposition of the whole subject, and illustrated by 252 distinct Figures; folio; 1859 .... *Esterbrook & Monckton.*

4.—BIOGRAPHY OF ARTISTS, ENGINEERS, INVENTORS, MANUFACTURERS, &c.

Biography of Distinguished Scientific Men; 1st series; 12mo; 1859 .... *Arago.*
" " " 2nd " " " .... "
Biographical Sketches of Eminent Living Characters; 12mo; 1857 .... "
Dictionary of Painters, Pilkington's; 8vo; 1857 .... *Cunningham.*
Memoir of H. Howard; 12mo .... *F. Howard.*

5.—CATALOGUE OF BOOKS, APPARATUS, MANUFACTURES, &c.

Appleton & Co.'s Catalogue of Books.
" " Apparatus.
American Publisher's Circular; weekly.
Bohn's Catalogue of Books.
Bookseller (British), monthly.
Bookbuyer's Manual .... *Putnam.*
Catalogues of the Libraries of the principal Mechanics' Institutes in Upper Canada.
Catalogue of Books of the Department of Public Instruction in Upper Canada.
Great Seal Patent Office Library Catalogue of Books; London.
Hand Book of Mechanics' Institutions (British).
Harper & Brothers' Catalogues of Books.
Literary and Educational Year Book; 12mo; 1860.
London Catalogue of Books; 1831 to 1855.
Maw & Co.'s Coloured Pattern Books of Encaustic Tiles, &c., designed by Digby Wyatt; with Price Lists.
Palmer's Catalogue of Books.
Society of Arts (London) List of Paid and Unpaid Lecturers, with Catalogue of Apparatus and Diagrams.
South Kensington Museum, London:
  Library Catalogue of the Department of Science and Art.
  Catalogue of Casts in ditto.
  Inventory of the Museum of Ornamental Art.
  Directory, with Examples and Models for Schools of Art.
  Catalogue and Price List of Re-productions of Works of Art.
Ticknor & Field's Catalogue of Books.
Weale's Catalogues of Books.
Willis & Sotheran's Catalogues of New and Second-hand Books.
" Price Current; monthly.
Sundry small Catalogues.

6.—DECORATION AND ORNAMENT, AND DESIGNING (Not embraced in Class 3).

Application of Arts to Manufactures, with 150 Illustrations; 12mo; 1858 .... *Mason.*
Designs for Monuments; folio; 1852 .... *Clarkson.*
" Fonts, Mural Tablets, Chimney Pieces, Balustrades, &c.; folio; 1852 .... "
Decorative Arts of the Middle Ages; 4to; 1851 .... *H. Shaw.*
Decorative and Ornamental Art: 500 Examples from the New York International Exhibition; folio; 1853.
Encyclopedia of Ornament; 4to; 1842 .... *H. Shaw.*
Embroiderer's Book of Design, containing Initials, Emblems, Cyphers, &c.; 8vo; 1860 .... *Delamotte.*
Floriated Ornament; folio .... *Pugin.*
Gothic Ornaments, from the Eleventh to the Sixteenth Century; folio; 1854 .... "
Geometrical Diaper Designs, as applied to the Decorative Arts; folio; 1844 .... *D. R. Hay.*
Glazier's Book of Design; 8vo; 1848 .... *H. Shaw.*
Illuminated Book of Needle Work; 12mo; 1857 .... *Mrs. Owen.*
Lady's Manual of Fancy Work, with over 300 engravings; 12mo .... *Mrs. Pullan.*
Medieval Iron Work (Serrurerie du Moyen—Age) .... *Raymond Bordeaux.*
Maw & Co.'s Books of Designs of Geometrical, Mosaic and Encaustic Tiles; 4to; paper .... *Digby Wyatt.*
Ornamental Metal Work, and its Artistic Design; folio; 1852 .... "
Ornamental Metal Work, Examples of; 4to; 1836 .... *H. Shaw.*
Official Illustrated Catalogue of the London International Exhibition; 3 vols., folio; 1851.
Primer of the Art of Illumination; 12mo; 1860 .... *Delamotte.*
Specimens of Ancient Furniture; folio; 1836 .... *H. Shaw.*
Universal Decorator; 3 vols., 4to; 1858–'59–'60 .... *Thompson.*

7.—DICTIONARIES, DIRECTORIES AND ENCYCLOPEDIAS.

Crests of the Families of Great Britain and Ireland; 2 vols., 8vo........ *Fairbairn.*
Chronological Tables, Blair's; 12mo; 1856........ *J. W. Rosse.*
Cyclopedia of Physical Sciences; 8vo; 1857........ *J. P. Nichol.*
Cyclopedia of Practical Receipts; 8vo; 1859........ *A. J. Cooley.*
Canada Directory, Lovell's; 8vo; 1857.
Catalogue of the London Exhibition of 1851, descriptive and illustrative; 3 vols., folio.
Cyclopedia of Drawing, Appleton's; 8vo; 1857........ *W. E. Worthen.*
Dictionary of Dates, Haydn's; 12mo; 1860........ *Vincent.*
Dictionary of Arts, Manufactures and Mines, Ure's. 3 vols., 12mo; 1860........ *R. Hunt.*
Dictionary of Science, Literature and Art; 8vo; 1852........ *W. T. Brande.*
Dictionary of Painters, Pilkington's; 8vo; 1857........ *Cunningham.*
Dictionary of the English Language; 4to; 1860........ *Worcester.*
English Cyclopedia of Arts and Sciences; 8 vols., 4to; 1859 to '61........ *C. Knight.*
Encyclopedia of Ornament; 4to; 1842........ *H. Shaw.*
Encyclopedia of Heraldry of England, Scotland, and Ireland; comprising a Registry of all Armorial bearings from the earliest to the present time; 8vo........ *Burke.*
Encyclopedia Britannica; a Dictionary of Arts, Sciences and General Literature; 22 vols., 4to; 1859 to '61.
Encyclopedia of Architecture, Nicholson's; 2 vols., 4to........ *Lomax & Gunyon.*
Encyclopedia of Chemistry; 8vo; 1854........ *J. C. Booth.*
Encyclopedia of Cottage, Farm and Villa Architecture and Furniture; 8vo; 1853........ *Loudon.*
General Gazetteer: a Dictionary of Geography; Descriptive, Physical, Statistical and Historical; 8vo; 1852........ *A. K. Johnston.*
Hand Book of Practical Receipts; 12mo; 1857........ *Branston.*
Index of Dates; 12mo; 1858........ *J. W. Rosse.*
Iron Manufacturer's Guide to the Furnaces and Rolling Mills of the United States; 8vo; 1859.. *J. P. Lesley.*
Illustrated Catalogue of the Bernal Collection of Works of Art, with an Essay on Pottery and Porcelain, and engraved lists of Marks and Monograms; 12mo; 1857........ *H. G. Bohn.*
London Post Office Directory; 8vo; 1860.
Literary and Educational Year Book; 12mo; 1860.
McKenzie's Five Thousand Receipts; 8vo.
Men and Women of the Time; 12mo; 1857.
Toronto Directory, Caverhill's; 12mo; 1859.
Toronto Directory, Brown's; 8vo; 1861.

8.—DRAWING AND GEOMETRY.

Cyclopedia of Drawing, comprising Geometrical Projection, Mechanical, Architectural and Topographical Drawing; Perspective and Isometry; 8vo; 1857........ *Worthen.*
Engineer and Machinist's Drawing Book; folio; 1855........ *Blackie.*
Elements of Perspective; 12mo; 1860........ *Ruskin.*
Elements of Map Drawing; 8vo; 1859........ *Carter.*
Geometrical and Mechanical Drawing; a Text Book; 8vo; 1859........ *Minifie.*
General Problems from the Orthographic Projections of Descriptive Geometry, with their Applications, &c.; 8vo; 1860........ *Warren.*
Instructions in Practical Geometry, Drawing, &c.; folio; 1860........ *Newlands.*
Linear Perspective, a Manual of; 12mo; 1857........ *R. S. Smith.*
Practical Draughtsman's Book of Design; 4to; 1857........ *Armengaud.*
Practical Geometry, Linear Perspective, and Projection; with Descriptions of the Principal Instruments used in Geometrical Drawing, &c.; 8vo........ *Bradley.*
Topographical Drawing, a Manual of; 8vo; 1859........ *R. S. Smith.*

9.—ENGINEERING AND MECHANICS.

Construction of Wrought Iron Bridges, embracing the practical application of the principles of Mechanics to Wrought Iron Girder Work; 8vo; 1858........ *Latham.*
Heat, in its relation to Water and Steam; embracing new views of Vaporisation, Condensation and Explosions; 8vo; 1861........ *C. Wye Williams.*
Mechanical Principles of Engineering and Architecture; 8vo; 1856........ *Moseley.*
Mechanics of Machinery and Engineering; 2 vols; 8vo; 1848........ *Wiesbach.*
Mechanics for Practical Men; 8vo; 1850........ *Jamieson.*
Mechanics and Mechanism: Essays and Examples; 12mo; 1853........ *R. S. Burn.*
New Method of Calculating the Cubic Contents of Excavations and Embankments, by the aid of Diagrams; 8vo; 1853........ *Trautwine.*
Strength of Materials used in Engineering Constructions; 12mo; 1860........ *Whildin.*
Tables for facilitating the Calculation of Earth Work, in the cutting of Embankments, &c.; 8vo; 1846........ *McNeill.*

10.—FINE ARTS.

Art Mythology, with 100 plates of illustrations, in outline; folio; 1856........ *E. Braun.*
Ancient and Modern Sculpture; 60 plates of illustrations, in outline; 4to........

A Familiar Introduction to Heraldry, explaining the principles of the science, and shewing its application to the study of History and Architecture; illustrated by numerous engravings; 12mo; 1848	*Barrington.*
Colour as a means of Art; being an adaptation of the experience of Professors to the practice of Amateurs; 12mo; 1849	*F. Howard.*
Instructions in Lithography, Ink, Chalk and Chromo; 12mo	*Ruse & Stracker.*
Lectures on Painting, delivered at the Royal Academy of Fine Arts; 12mo; 1848	*H. Howard.*
Laws of Contrast of Colour, and their application to the Fine and Industrial Arts; 12mo; 1859.	*Chevreul.*
Painting Popularly Explained; 12mo; 1859	*Gullick & Timbs.*
Theory and Practice of Landscape Painting in Water Colours, illustrated by colored drawings and woodcuts; 8vo; 1861	*Barnard.*

11.—GEOGRAPHY, TOPOGRAPHY AND STATISTICS.

Atlas of the United States and British and Central America; folio; 1857	*J. K. Johnston.*
Census of Canada in 1851–2; 2 vols., 8vo.	
General Gazetteer; 8vo; 1852	*J. K. Johnston.*
National Atlas of Historical, Commercial and Political Geography; folio; 1850	"
Topographical Dictionary of England and Wales; 8vo	*Tallis.*

12.—GEOLOGY, METALLURGY, MINES AND MINING.

Chemistry and Metallurgy of Copper, and the Art of Mining and Preparing the Ores for Market, &c.; 12mo; 1858	*Piggot.*
Iron; its History, Properties, and Processes of Manufacture; 12mo; 1861.	*Fairbairn.*
Iron Ores; 8vo; 1850	*Overman.*
Metals and their Alloys, including Mining Ventilation, Mining Jurisprudence; and Metallurgic Chemistry employed in the Conversion of Iron, Copper, Tin, Zinc, Antimony and Lead Ores, with their Applications to the Useful Arts; 12mo.	*Scoffern, Truran, Clay, Oxland, Fairbairn, Aitkin and Pickett.*
Story of a Boulder, or Gleanings from the Note-book of a Field Geologist; 12mo; 1858	*A. Geikie*
Ure's Dictionary; 3 vols.; 12mo; 1860	*R. Hunt.*

13.—HORTICULTURE, AGRICULTURE, AND RURAL AFFAIRS.

American Home Garden; 8vo; 1860	*Watson.*
Landscape Gardening and Landscape Architecture, of the late H. Repton; 8vo; 1840	*Loudon.*
Prize Essay on the Insects and Diseases injurious to the Wheat Crops; 8vo; 1857	*H. Y. Hind.*
Practical Hints on Landscape Gardening, with Remarks on Domestic Architecture; 8vo; 1835	*Gilpin.*
Rural Affairs: an Illustrated Register of Rural Economy; 440 engravings; 8vo; 1858	*J. J. Thomas.*
" " " " " " " 1860	"
System of Grape Culture; adapted to the Vineyard, the Grapery, and the fruiting of Vines in pots, in trellises, arbors, &c.; 8vo; 1860	*W. Bright.*
Theory and Practice of Landscape Gardening, adapted to North America; illus.; 8vo; 1860	*Downing.*
The Orchard House, or Culture of Fruit Trees in pots under glass, with Plans for Construction, Management, &c.; 8vo; 1860	*Rivers & Saunders.*
Western Fruit Book, or American Fruit Grower's Guide; 8vo; 1860	*Elliott.*

14. MANUFACTURES, TRADES, AND INDUSTRIAL ARTS IN GENERAL.

Application of Art to Manufactures, with 150 illustrations; 12 mo; 1858	*Mason.*
Art of Weaving, with Calculations and Tables for the use of Manufacturers; 12mo; 1859.	*Murphy.*
Carpenter and Joiners' Assistant; folio; 1860	*Newlands.*
Carpenter's New Guide; 4to; 1856	*Sloan.*
Clock and Watchmaker's Manual, with numerous engravings; 12mo; 1860	*Booth.*
Dyeing and Calico Printing, including the latest inventions and improvements, with engravings; 8vo; 1860	*Macfarlane.*
Iron, its History and Manufacture; 12mo; 1861	*Fairbairn.*
Manufacture of Iron in Great Britain; 8vo; 1857	*Wilkie.*
Manufacture of Iron in all its various branches, with descriptions of Machinery, Blast Furnaces, &c.; 150 engravings; 8vo; 1850	*Overman.*
Manufacture of Photogenic or Hydro-Carbon Oils, from Coals and other Bituminous substances; 8vo; 1859	*Antisell.*
Manufacture of Vinegar, its theory and practice; 12mo; 1860	*Wetherill.*
Printing and its Accessories, with samples of paper; 12mo	*Ruse & Straker.*
Practical Treatise on Coal, Petroleum, and other distilled Oils; 8vo; 1861	*Gesner.*
The various processes of Copper smelting, &c.; 12mo; 1858	*Piggot.*
Turning and Mechanical Manipulation; 3 vols., 12mo; 1859:—	
Vol. 1. Materials, their preparation and figuration.	
" 2. Construction, action, and application of Cutting Tools.	
" 3. Abrasive and miscellaneous processes	*Holtzapffel.*
Ure's Dictionary of Arts, Manufactures, &c.; 3 vols., 12mo; 1860	*R. Hunt.*
Wool and Woollen Manufactures of Great Britain; 12mo; 1859	*Samuel, Brothers.*

15. MISCELLANEOUS; And Works treating on Subjects in more than one Department of the Library.

Automatic Mechanism, as applied in the construction of Artificial Limbs; 12mo; 1857...... *Gray.*
Canada at the Universal Exhibition of 1855; 8vo.
Catalogue of the World's Exhibition, New York; folio; 1853.
Catalogue of the International Exhibition of London, illustrated; 3 vols., folio; 1851.
Narrative of the Canadian Red River, and Assiniboine and Sackatchewan Exploring Expedition, in 1857-8; 2 vols., 8vo. .... *H. Y. Hind.*
Prize Essay on Canada.......... *Hogan.*
Remarkable Inventions of the present century; 12mo; 1859 .... *Bakewell.*
Triumphs of Invention and Discovery; 12mo; 1861.......... *J. H. Fyfe.*
Theory and Practice of International Trade; 12mo; 1858 .... *Barry.*

16.—NATURAL HISTORY—(General).

American Weeds and Useful Plants; 12mo; 1860 .... *Darlington.*
Botany, Manual of; 12mo; 1859 .... *Gray.*
Botany, First Lessons in, with 360 wood-cuts; 12mo; 1860.......... *Gray.*
Cuvier's Animal Kingdom, illustrated; 8vo; 1859 .... *Carpenter & Westwood.*
Entomology; or Elements of the Natural History of Insects: their Metamorphoses, Food, &c. &c.; 12mo; 1860 .... *Kirby and Spence.*
General view of the Animal Kingdom; a large map; 1858 .... *Redfield.*
Illustrated Natural History of the Animal Kingdom; 2 vols., 8vo; 1861.......... *Goodrich.*
Zoological Science, or Nature in Living Animals; 12mo; 1858 .... *Redfield,*

18.—PATENTS OF INVENTIONS AND DESIGNS.

Commissioner of Patents Journal; 6 vols., 8vo; 1854 to 1859 .... *British.*
Indexes:—

Alphabetical Indexes of Patentees,	7 vols., 8vo;	1617 to 1858	"
Chronological Index of Patents,	8 "	" "	"
Fire Arms and Projectiles Index,	1 "	1718 to 1853	"
Reference Index of Patents,	2 "	1617 to 1855	"
Subject Matter Indexes of Patents	9 "	1617 to 1858	"

Library Catalogue of G. S. Patent Office; 2 vols., 8vo; 1858 .... "
Reaping Machines, Appendix to Specifications; 8vo; 1853 .... "
Specifications of Inventions; 168 vols., 8vo; 1852 to 1858 .... "
Specifications of Inventions; Plates; 202 vols., folio; 1852 to 1858.......... "
Specifications of Inventions; Protection for Inventions; Patent Rights in British Colonies and Foreign Countries; and lists of prices of printed specifications from 1617 to 1858; 1 vol., 8vo .... "
Specifications of Inventions; Key of Term and Phrases in Titles, &c.......... "
Specifications of Inventions; 5 vols., 12mo; 1858 .... "

Vol. 1. Marine Propulsion.
" 2. Steam Culture; Aids to Locomotion.
" 3. Manufacture of Iron and Steel.
" 4. Food; Watches, Clocks, &c.; Synopsis of Patents.
" 5. Manure; Drain Tiles and Pipes; Sewing and Embroidery.

Specifications and Plates of Patented Inventions in Canada; 1 vol., 8vo.; 1824 to 1849.
Patent Laws of the United States; 1861.
Rules and Directions for proceedings in the Patent Office of the United States; 1861.

19.—PARLIAMENTARY AND MUNICIPAL PUBLICATIONS.

Consolidated Statutes of Canada; 8vo; 1859.
" " Upper Canada; 8vo; 1859.
Census of Canada; 2 vols., 8vo; 1851-2.
Legislative Council, Journals of; 6vo.
" " Sessional Papers; 31 vols.
Legislative Assembly, Journals of, 7 vols.
" " Appendixes to ditto; 41 vols.
Maps, Reports, and Estimates for improving the navigation of the River St. Lawrence; and a proposed canal connecting the River St. Lawrence and Lake Champlain; folio; 1856.
Report of Commissioner of Crown Lands of Canada: Maps of Canada; 4to; 1857.
Standing Orders of the Legislative Council.
Statutes of Canada; 2 vols.; 1857-8.
Tables of the Trade and Navigation of Canada; 7 vols.; 1852 to 1858.
Various Parliamentary Reports, Returns, &c., &c.; Pamphlets.

20.—PERIODICALS.

American Publishers' Circular; weekly.......... *New York.*
Athenæum; weekly .... *London.*

Artizan; monthly	"
Bookseller "	"
Builder; weekly	"
Civil Engineer and Architect's Journal; monthly	"
Commissioner of Patents Journal; semi-weekly	"
Canadian Journal; bi-monthly	*Toronto.*
Canadian Agriculturist; semi-monthly	"
Canada Gazette; weekly	*Quebec.*
Journal of Gas Lighting, Water Supply, and Sanitary Improvement; semi-monthly	*London.*
Journal of Education for Upper Canada	*Toronto.*
" " Lower Canada	*Montreal.*
Laxton's Examples of Building; monthly	*London.*
Lardner's Museum of Art; weekly	"
Mechanic's Magazine; weekly	"
Photographic Notes; semi-monthly	"
Society of Arts Journal; weekly	"
Scientific American; "	*New York.*
Willis & Sotheran's Price Current of New and Second Hand Books; monthly	*London.*

21.—SCIENCE (General.)

Bookkeeping by single and double entry; 8vo; 1860	*Preston.*
Chemical Recreations: a popular Manual of Experimental Chemistry; 12mo; 1854	*Griffin.*
Chemistry of the Non-Metallic Elements and their Compounds, including a comprehensive course of class experiments; 12mo; 1860	*Griffin.*
Chemical Technology; or Chemistry applied to the Arts and Manufactures; 2 vols., 8vo; 1848	*Knapp.*
Experimental Researches in Chemistry and Physics; 8vo; 1859	*Faraday.*
Heat in its relations to Water and Steam; 8vo; 1861	*C. Wye Williams.*
Introduction to Heraldry; 12mo; 1848	*Barrington.*
Illustrated London Astronomy; 12mo	*J. R. Hind.*
Manual of Elementary Chemistry; Theoretical and Practical; 12mo; 1861	*Fownes.*
Manual of Technical Analysis; 12mo; 1857	*Bolley.*
Mechanical Philosophy, Horology, and Astronomy; 12mo; 1857	*Carpenter.*
The Principles of Chemistry illustrated by simple Experiments; 12mo; 1859	*Stockhardt.*
The Steam Engine, its Origin and gradual Improvement; 8vo; 1840	*Hodge.*
The Steam Engine, Plates; folio	"

FREE LIBRARY OF REFERENCE, AND MODEL ROOMS.

The Library of Reference and Model Rooms of the Board of Arts and Manufactures for Upper Canada, are open to the public free, from 10 a.m. till noon, and from 1 to 4 o'clock, p.m., daily, in the New Hall of The Toronto Mechanics' Institute.

The Library contains several hundred volumes of valuable books of Reference in Architecture, Decoration and Ornament, Designing, Encyclopedias, Engineering and Mechanics, Manufactures and Trades, General Science, Patents of Inventions of Great Britain and Canada, &c., &c., &c.

The Model Rooms contain several hundred models of Patented Canadian Inventions, and the commencement of a Museum of specimens of Foreign and Canadian Manufactures.

The Manufacturers of Canada are respectfully invited to furnish specimens of their various productions, or of any natural products capable of being used in Manufactures, for Exhibition in the Rooms.

Specimens of Machinery, or of other bulky manufactured articles, are requested to be furnished in model.

NOTICES OF BOOKS.

Lovell's General Geography, for the use of Schools; with numerous Maps, Illustrations, and Brief Tabular Views. By J. George Hodgins, LL. B., F. R. G. S. Toronto: R. & A. Miller, 62 King Street East.

Those engaged in tuition in this country have long felt the want of a proper geographical text book, a want which we are glad to observe has at length been supplied by our enterprizing publisher, Mr. Lovell. The expense of English Geographies, rendering an Atlas necessary, has precluded their introduction into our Common Schools, while they do not supply sufficient information concerning British America. From motives of economy therefore, "Morse's American Geography," combining atlas with text, has been used in most of our educational institutions, but for many reasons this treatise is highly objectionable. Compiled for the use of schools in the American States, the greater part of the work is devoted to a description of that country, whereby young students are apt to form a false estimate of the importance of the States, while they are left in comparative ignorance of other parts of the world.

Mr. Lovell presents us with a Geography superior to Morse's, illustrated with coloured maps, diagrams, and numerous engravings, specially prepared and

admirably adapted for the use of schools in British America. Half of the work is occupied with a description of the American Continent, accurate maps and information being given of the British Provinces, while the States are treated of as fully as their importance deserves. Other portions of the globe are described at sufficient length, and throughout the whole work the author seems to have striven to convey to the student a just idea of every country. The information is derived from the best and most recent authorities, and is conveyed in a concise and easy style.

We would recommend it to those who intend to present themselves as candidates for certificates in geography at the Examinations of the Board of Arts and Manufactures for Upper Canada.

The Works of Francis Bacon, Baron of Verulam, Viscount St. Albans, and Lord High Chancellor of England. Collected and edited by James Spedding, M.A., Robert Leslie Ellis, M.A., and Douglas Denon Heath. Vol. I.; being the first volume of the Philosophical Works. Boston: Brown & Taggard. Toronto: Rollo & Adam. 12mo. 1860. Pp. 539.

Of this new and beautiful edition of Bacon's Works, undertaken editorially by Mr. Spedding, assisted by Messrs. Ellis and Heath, all of Trinity College, Cambridge, England, six volumes have now been published. The one before us, though the sixth in the order of publication, is Vol. I. of the whole series, and the First volume of the Philosophical Works; the five previous ones (numbered from XI. to XV. consecutively), which contain Lord Bacon's Literary and Professional works, having first been made ready for the press. The remaining volumes will, we are informed, be published in regular order from Vol. I. to X. inclusive, and will contain the Philosophical and Occasional works.

The present volume opens with an interesting account of the history and plan of this edition, from the pen of Mr. Spedding. From it we learn that it was originally intended that each of the three divisions of Bacon's works should be undertaken by a separate editor, namely, the Philosophical works by Mr. Ellis, the Professional by Mr. Heath, and the Occasional and Literary by Mr. Spedding; each division to be made complete in itself, and each editor to be solely responsible for his own part of the work. Unfortunately, however, for this arrangement, Mr. Ellis was compelled by a severe illness to give up his share of the undertaking, though not before the greater portion of his task had been done. His part, therefore, has been filled up and completed, where necessary, as well as made ready for the press, by Mr. Spedding; who, however, has marked for the information of the reader all the additions or alterations for which he is responsible.

The volume proper begins with "The Life of the Honourable Author," by his Chaplain, Dr. Rawley, who, in his opening sentence, well describes his patron as "the glory of his age and nation, the adorner and ornament of learning." This memoir, written as it is by one who speaks from intimate and familiar knowledge during many years, and who is the only one among Bacon's personal friends by whom any particulars of his life have been recorded, contains by far the most authentic and important evidence concerning him that we possess, though, as might be expected, it is at the same time very favourable and affectionate.

We next have an exceedingly valuable as well as interesting general Preface to Bacon's Philosophical Works, by Mr. Ellis. In this he gives a very lucid explanation of the various reforms in philosophy which Bacon designed to introduce; especially of his doctrine of "Forms," and theory of the formation of Conceptions, and also of his method of Inductive Reasoning, the distinguishing features of which are its absolute certainty, and its mechanical mode of operation, which is such that it renders all men equally capable, or nearly so, of employing it, and so of attaining to the truth. He concludes by summing up what he considers Bacon's chief merits to consist in, and these he justly declares belong rather to the spirit than to the positive precepts of his philosophy. They may be briefly enumerated in the following manner:—First, the good service he rendered when he declared with all his eloquence, and all the weight of his authority, that "the true end of knowledge is the glory of the Creator, and the relief of man's estate." Next, his clear view of the essential unity of science; his perpetual enforcement of the necessity of laying aside all preconceived opinions and learning, in order to become a true follower of nature; his rejection of syllogistic reasoning in the establishment of axioms, a method which had been unduly exalted during the middle ages. And lastly, the tone in which he spoke of the future destiny of mankind. From such causes as these it was, that the influence which Bacon has exerted has been greater, probably, than that of any other uninspired man; for, while his philosophy has been in some degree pernicious, it has also done a vast amount of good.

In addition to the General Preface to the Philosophical Works, we have a Preface to the *Novum Organum*, also by Mr. Ellis, with the exception of the last few pages, which were added by Mr. Spedding, who has also, in the form of an appendix, given us his own views on some disputed points in Mr. Ellis' argument. This preface, while it furnishes a general account of the *Novum Organum*, is chiefly valuable for the excellent analysis it gives of the first book.

We now come to what occupies the remainder, and greater portion of the volume — Bacon's *Instauratio Magna*, containing the *Distributio operis*, and the second part, or *Novum Organum*. Of the wonderful learning and ability displayed in this his most celebrated work, it is needless for us to speak; in the words of Macaulay, "all the peculiarities of his extraordinary mind are found there in the highest perfection. Every part of the book blazes with wit, but with wit which is employed only to illustrate and decorate truth. No book ever made so great a revolution in the mode of thinking, or

overthrew so many prejudices, introduced so many new opinions; yet no book was ever written in a less contentious spirit. But what we most admire is the vast capacity of that intellect which, without effort, takes in at once all the domains of science—all the past, the present, and the future—all the errors of two thousand years—all the encouraging signs of the passing times—all the bright hopes of the coming age." Such language, coming as it does from one who has probably done more than any other writer to detract from Lord Bacon's reputation, is assuredly an encomium of no ordinary value.

We have now but to add that this edition is one of the best specimens of typography that has yet been produced in America; in fact, in style and execution it is quite equal to anything brought out by the best publishing houses in England. We are pleased to learn from the publishers that the list of subscribers is constantly increasing, and that it now numbers nearly one thousand. In conclusion we cannot refrain from stating our opinion that this is a work that ought to have a place on the shelves of every Mechanics' Institute library throughout the country; indeed no library of any pretensions can be considered complete without it.

What Illuminating Was. A Manual of The History of the Art. Part I.

What Illuminating Should Be, and how it may be Practised. A Technical Manual. Part II. By M. DIGBY WYATT, V. P. R. I. B. A.; with Illustrations, by W. R. TYMMS. Condensed from "The Art of Illuminating" by the same Author and Illustrator. London: Day & Son, Lithographers to the Queen. Toronto: Rollo & Adam.

The first part of this Work is devoted to a history of Illuminating, or the art of adorning manuscripts with colour. The characteristics of the several existing manuscripts are described, and the history is made as perfect as the space devoted to it would permit. The author bears testimony to the industry and genius of the transcribers of the sacred and other volumes during the middle ages, and endeavours to impress on his readers the value and usefulness of their labours in an artistic, as well as a literary point of view.

The second part is divided into two portions. 1st. "What Illuminating Should Be," and 2nd. "How Illuminating may be Practised." In the first section the author advocates its use as a decoration in our buildings, and gives directions to the student how to proceed in copying the plates with which the volume is illustrated. In the second section instructions are given in the preparation of the several pigments and their application to various materials, and all necessary information is supplied for the practice of illuminating. The plates interspersed through both parts are twenty-four in number, and serve both as copies for the student, and as fac-similes of some of the famous illuminated writings. We have among them specimens of "Charles the Bald's Bible;" "The Bedford Missal;" "Charlemagne's Bible;" and "The Missal of Ferdinand and Isabella o Spain." The price of the two parts is but 90 cents, and is therefore within the reach of all, and is useful not only to those who may be inclined to devote some of their leisure time to illuminating, but also to those who desire to know something of the history, and to possess a fac-simile of some of the Mediæval Manuscripts.

The following extract from the second part of the work will shew its style, and the extent to which the author would desire to see the art applied.

"Illumination, in whatever form practised, can never be properly regarded as any other than one of the genera into which the art of Polychromatic decoration may be subdivided. What was originally termed illumination, was simply the application of minimum or red lead, as a colour or ink, to decorate, or draw marked attention to, any particular portion of a piece of writing; the general text of which was in black ink. The term was retained long after the original red lead was almost entirely superseded by the more brilliant cinnabar or vermillion. As ornaments of all kinds were gradually superadded to the primitive distinctions, marked in manuscripts by the use of different coloured inks, the term acquired a wider significance, and, from classical times to the present, has always been regarded as including the practice of every description of ornamental or ornamented writing.

"Because such embellishments were, during the early and middle ages, and, in fact, until long after the invention of printing, almost invariably executed on vellum, there is no reason whatever why illumination should be applied to that material, or to paper, which has taken its place, only; wood, metal, slate, stone, canvass, plaster, all may be made to receive it. Again; because ancient illumination was almost entirely executed in colours, in the use of which water and some glutinous medium were the only "vehicles," there is no reason why modern illumination should not be worked in oil, turpentine, encaustic, fresco, tempera, varnish, and by every process in which decorative painting is ever wrought in these days. It is in such an extension that the most valuable functions of the art are likely to consist in all time to come. The utilitarian application which it, originally and for so many centuries, found in the production of beautiful books, copies of which could be elaborated by no other means than hand labour, has been, to a great extent, superseded by chromolithography and chromotype. No doubt a wide field for useful and even productive labour, is still left to the practical illuminator on paper and vellum, in designing and preparing exquisite originals for reproduction by those processes, as well as in the rich and tasteful blazoning of pedigrees, addresses, family records and memorials, and in the illustration for presentation, or for private libraries, of transcripts from favourite authors; but, at the same time, an equally elegant and useful application of the art would be to enrich ceilings, walls, cornices, string-courses, panels, labels, round doors and windows, friezes, bands, chimney-pieces, and stained and painted furniture in churches, school-rooms, dwellings, and public buildings of all kinds, with beautiful and appropriate inscriptions, of graceful form and harmonious colouring. Such illumination would form not only an agreeable, but an eminently useful decoration. How many texts and sentences, worthy, in every sense, of being 'written in letters of gold,' might not be thus brought prominently under the eyes of youth, manhood and old age, for hope, admonition, and comfort. No more skill, energy, and taste are requisite for the production of this class of illumination, than are essential for satisfactory work upon vellum and paper; and

while in the one case the result of labour may be made an incessant employment for many, in the other it is seldom more than a nine days' wonder. shut up in a book or portfolio, and seen so seldom as scarcely to repay the amateur for the expense and trouble involved in its execution."

The Emigrant, and other Poems. By ALEX. McLACHLAN. Toronto: Rollo & Adam. 1 vol.; 16mo. 1861. pp.236.

Though this little work does not properly come within the limits we prescribed for ourselves in our literary notices, we cannot forbear transgressing our rule, and affording it a little space in our columns, especially as it is the production of one who has taken up his abode in our midst, and its publication is a Canadian enterprise.

The author has not inaptly taken as his motto the well known quotation, "*Cœlum non animum mutant, qui trans mare currunt;*" for his mother country and native dialect shew themselves in every page. The Scottish element is plainly conspicuous also in the characteristic prejudices, the keen satires, and narrow doctrines, mingled with tender sympathies and joyous aspirations, which are visible throughout his poems. The opening piece, from which the book takes its title, would be far less interesting, were it not diversified by a number of episodes in the shape of songs sung by several of the characters introduced, which are decidedly the best part of the poem. His minor pieces are, to our taste, by far the best; throughout them all there breathes an independent spirit, and most of them exhibit a knowledge of human nature which is the great characteristic of our author's productions. Our limited space forbids our introducing any extracts from those of his lays which please us most; we must therefore content ourselves with enumerating a few of them. Among the first we would mention "Charloch Ban," a piece adapted to an old Highland tune. The "Ode on the Prince of Wales' Visit," and "The Seer," will be admired by many. We ought not to conclude without observing that our bard might make some improvement in his rhymes, without detracting from the beauty and originality of his pieces: many of them are barely admissible, and, indeed, in a younger aspirant after poetical fame would not be tolerated at all.

With regard to the typographical execution and general appearance of the work, the publishers deserve great credit. It is indeed a very fair specimen of the manner in which books can be got up in this country. We heartily wish the enterprising publishers every success in their undertaking.

We intend to publish in each future No., a selected alphabetical list of Books issued in Great Britain and the United States, during the previous month; principally from that class of Works most suited to the Libraries of Mechanics' Institutes, and other similar Associations.

BRITISH PUBLICATIONS FOR JULY.

	Stg. prices.			
Alison, A., American Revolution and its Consequences to England, 8vo	£0	0	6	*G. H. Nichols*
Arago, François, Popular Treaties on Comets, transl., 8 vo	0	5	0	*Longman*
Atlas (Royal) of Modern Geography, by A. K. Johnston, folio	5	15	6	*Blackwoods*
Beaufort, Emily A., Egyptian Sepulchres and Syrian Shrines, 2 vols. post 8 vo	1	5	0	*Longman*
Bicknell, Algernon S., In the Track of the Garibaldians through Italy, &c., post 8vo	0	10	6	*Manwaring*
Blakely, R., History of General Literature, 2 vols. in 1, 8 vo	0	8	0	*Bentley*
Bohn's English Gentleman's Library. Walpole's Letters, Vol. 5, 8vo.	0	9	0	*Bohn*
——— Illustrated Library. Milton's Poetical Works, with Memoir, Vol. 2, post 8vo.	0	5	0	*Bohn*
Bradshaw's Guide through London, new edit., 16mo	0	2	6	*Adams*
———— Illustrated Guide through Paris, new edit., 16mo.	0	1	6	*Adams*
Bradshaw's Illustrated Traveller's Handbook to France, new edit., square	0	5	0	*Adams*
Bridges, Frd., Phrenology made practical, and popularly explained, 2nd ed. fcap. 8vo	0	3	6	*Philip*
Buchanan, W.M., Technological Dictionary, explaining terms of Arts, &c. new ed. 12mo	0	4	6	*Tegg*
Carter, Thos., Medals of the British Army, Div. 2, Egypt, Peninsula, &c., 3 vo	0	7	6	*Groombridge*
Challis, Rev. Jas., Creation in Plan and in Progress, an Essay on Genesis, chap. 1, cr., 8vo	0	4	6	*Macmillan*
Chambers' Journal of Popular Literature, Science, &c., Vol. 15, Jan. to June, 1861, sup. royal, 8vo	0	4	6	*Chambers*
Cheshyre, H. T. N., Recollections of a Five Years' Residence in Norway, fcap. 8vo.	0	5	0	*Newby*
Cicero's Select Orations, by Chas. Anthon, revised by G. B. Wheeler, new edit. 12mo	0	4	0	*Tegg*
Circle of the Sciences (The), Vol. 6, Elementary Chemistry, new edit., cr. 8vo	0	5	0	*Griffin*
Cobbett, Wm., English Grammar, in a Series of Letters, new edit., 12mo	0	2	0	*Griffin*
Coghlan's Handbook for Italy, complete, 4th edit., fcap. 8vo	0	10	0	*Trubner*
Cook, Thos., Scottish Tourist Official Directory, with Maps, 8 vo.	0	2	0	*Tweedie*
Court Life at Naples in our own Times, 2 vols., post 8vo	1	1	0	*Saunders & O.*
Crockett, Col. David, Life and Adventures of, fcap. 8vo	0	0	6	*Beadle*
Cumming, Rev. Jos. Geo., Guide to the Isle of Man, fcap. 8vo	0	4	6	*Stanford*
De Vere, (Aubrey,) The Sisters, Inisfail, and other Poems, fcap. 8vo	0	5	0	*Longman*
Galbraith & Haughton's Manual of Mechanics, Key to, by J. M'Dowell, new ed. 12mo	0	6	0	*W. Allan*
Graham, G. F., Helps to English Grammar, new edit., fcap. 8vo.	0	2	6	*Longman*
——— Rev. Jno., Poems, Sacred, Didactic, and Descriptive, fcap. 8vo.	0	5	0	*Judd & Glass*
Great Fire, Illustrated History of the, 8vo	0	1	0	*Lea*
Greenwood, Thos., Political History of the Papacy (Cathedra Petri) Vol. 4. 8vo	0	14	0	*Thickbroom*
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Hall, Marshall, M. D., Memoirs of, by his Widow, 8vo.	0	14	0	*Bentley*

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Hare, Thos., Development of the Wealth of India; with Notes	0	1	0	*Macmillan*
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Humphry, G. M., Human Foot and the Human Hand, fcap. 8vo	0	4	6	*Macmillan*
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John Woodburn, Royal Navy, by Chartley Castle, post 8vo	0	10	6	*Saunders & Co.*
Johnson, Davis, The Last Week in the Life of, by J. D. Wells, fcap. 8vo. reduced to	0	1	0	*Nisbet*
Johnston, Alex. Keith, Royal Atlas of Modern Geography, folio	5	15	6	*Blackwoods*
Julian, Cardinal, the last Crusader, Life and Times of, by R. C. Jenkins, 8 vo	0	14	0	*Bentley*
Kittlitz, F. H. Von, 24 Views of the Vegetation of the Coasts, &c., of the Pacific, 4to	2	2	0	*Longman*
Knie, J. G., Guide to the Management and Education of Blind Children, fcap. 8vo.	0	1	6	*Simpkin*
Lambert, Benj., Lecture on Wit, Humor, and Pathos, fcap. 8vo	0	1	0	*Tresidder*
Lea, Wm., Tables of the Strength and Deflection of Timber, 2nd issue, cr. 8vo	0	5	0	*Weale*
Lee, Edward, Baths of Rhenish Germany, 3rd edit., re-issued, roy. 12mo	0	3	0	*Churchill*
Life in the Land of the Fire-Worshipper, by Charles de H——, 2 vols. post 8 vo	1	1	0	*Newby*
Lytton, Sir E. B., Harold the Last of the Saxon Kings, Library Edit. vol. 2, fcap.8vo	0	5	0	*Blackwoods*
M'Cosh, Rev. Jas., Association of Ideas, a Lecture, 12mo.	0	0	3	*Simpkin*
M'Culloch, J. M., Course of Elementary Reading, 39th edit, re-cast and enlarged 12mo	0	3	0	*Simpkin*
Madden, Fred. W., Handbook of Roman Numismatics, fcap. 8vo	0	5	0	*J. R. Smith*
Maling, E. A., Indoor Plants, and how to Grow Them, fcap. 8vo.	0	2	6	*Smith & Elder*
Mason, C. P., Eng. Grammar, includ. the Principles of Gram. Anal., 2nd ed., fcap. 8vo	0	2	6	*Walton*
——— Grammatical Analysis of Sentences, fcap. 8vo.	0	1	6	*Walton*
Maury, M. F., Physical Geography of the Sea, 10th edit., revised, post 8vo.	0	8	6	*Low*
Mayhew, Edw., Illustrated Horse-Doctor, 2nd edit., 8vo	0	18	6	*W. H. Allen*
Metcalfe, Rev. Fred., Oxonian in Iceland, Notes of Travel in 1860, post 8vo	0	12	6	*Longman*
Miller, Jas., Alcohol; its Place and Power. new edit., revised, post 8vo	0	3	0	*Sc. T. League*
Milton's Poetical Works, with Memoir; Vol. 2, Paradise Regained, &c., post 8vo	0	5	0	*Bohn*
Moss, Jno., Cotton Manufacturer's, &c., New Pocket Guide, 3rd edit. 12mo	0	2	6	*Low*
Muller, Max., Lectures on the Science of Language, 8vo.	0	12	0	*Longman*
Neale, Rev. J. M., Notes, Eccles. and Picturesque, on Dalmatia, Crotia, &c., post 8vo	0	6	0	*Hayes*
O'Bryne, Wm. R., Naval Biographical Dictionary, new and enlarged edit., Vol. 1, fol.	1	1	0	*O'Byrne Bras.*
O'Connor, Denis C., Seventeen Years' Experience of Workhouse Life, 8vo.	0	1	0	*M'Glashan & G.*
Pauli, Dr. Reinhold, Pictures of Old England, transl. by E. C. Otté, cr. 8vo.	0	8	6	*Macmillan*
Perry, Rev. Geo. J., History of the Church of England, Vol. 1, 8vo	1	1	0	*Saunders & Co.*
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Correspondence.

To the Editor of the Journal of the Board of Arts and Manufactures.

Sir,—I see by the August number of your Journal, that the Board of Arts and Manufactures offers a prize of $10 to each Mechanics' Institute in Upper Canada who may establish a class of not less than six members and submit not less than two members of such class for examination in any of the subjects mentioned in the programme of examination just issued by the Board for 1862. The Board also offers in addition to the certificates to be awarded to successful competitors, silver medals in the proportion of one to every five of the competitors who shall pass their final examination.

I would respectfully suggest to the Managers of Institutes in which classes may be formed, that they appropriate the $10 offered by the Board in prizes to be competed for within the respective classes, thus furnishing an additional inducement to their youthful members to engage in class instruction.

The annexed letter cut from the pages of the Journal of the Society of Arts, in England, I send for insertion in this Journal, believing that it contains suggestions that may be useful to the Managers and Members of Mechanics Institutes in this province who may be desirous to form discussion classes within their respective Institutes.

Such a class as is therein referred to has been in operation in the Toronto Mechanics' Institute for the past two seasons, and has been very successful. The members of the class, generally, have taken a great interest, and made very satisfactory progress, in its studies and exercises.

Yours respectfully,

A Member, T. M. I.

Toronto, July 23, 1861.

MECHANICS' INSTITUTIONS AND DISCUSSION CLASSES.

Sir,—The knowledge of our own language is one of the first and most important ends of education, and should form the prominent feature of adult instruction in the classes of Mechanics' Institutions. This is not implied, nor will it be accomplished by a mere knowledge of the formal rules of grammar. The object to be obtained is the capability of speaking and writing correctly, which may be materially promoted by a class for the reading and discussion of essays. It is a means of promoting the practice of English composition, and the emulation excited by an animated discussion often proves to be one of the most attractive features of an institution. Care should be taken to exclude all subjects connected with theology or party-politics, or which are calculated to excite angry feelings; and if a list of questions suitable for discussion be prepared, the difficulty of choosing an appropriate subject, which to the unpractised member too often appears insurmountable, would be in a great measure obviated. In order to assist the committees of Institutes in the furtherance of this object, I subjoin a few brief rules which have been circulated by the Yorkshire Union amongst the 143 Mechanics' Institutes comprised in it.

Rules.—The class should meet on one evening in each week, and elect a chairman for the evening.

Each member should in turn read an essay on some subject, either of history, literature, science, &c., to occupy not more than twenty minutes. It should then be open to discussion by the members of the class, the time occupied by each speaker not to exceed five minutes.

All members of the Institute to have free admission, but only the members of the class to take part in the discussion.

At the conclusion of the discussion, the chairman should sum up the arguments and take the votes of the members on the question at issue.

Any member unable or unwilling to prepare an essay may provide a substitute.

At the close of the season a premium may be awarded for the best essay which has been read.

Hints to the Members.—In the essay it is advisable that the affirmative of the question be maintained. Succeeding speakers should, as far as possible, confine themselves to the salient points of the preceding arguments.

All personalities and egotistical expressions should be carefully avoided.

In discussion, admit as much as possible of what has been advanced by an opponent.

It is important to check the slightest inclination to petulance or ill-temper.

Brevity is as valuable in speaking as in writing.

An opponent should never be accused of acting from wrong motives.

Each argument should be clearly stated, and honestly and calmly answered.

A respectful tone and gentlemanly demeanour should be preserved.

Let me hope that, the attention of those who have the management of Mechanics' Institutions being called to the above few suggestions, it may be the means of stimulating some of them to increased energy. They will not find much difficulty in preparing a list of suitable questions.

I am, &c.,

Barnett Blake.

To the Editor of the Journal of the Board of Arts and Manufactures.

Mr. Editor,—In the Report of the Board of Arts and Manufactures, published in your last No., the committee in referring to the failure of the projected class examinations last May, give it as their opinion that it was owing to the short notice given, and the neglect of Mechanics' Institutes in forming classes. Now, doubtless, this does explain the circumstance, but only in part. They would be very good reasons for the *scarcity* of candidates, but not for their *total* absence. The real reason, in my opinion, is, that the Board did not offer sufficient inducement to candidates, the only reward held out being certificates. Now, without seeking to underrate these certificates, I would ask, what possible value or benefit would they be to the competitors? Would their possessors enjoy any peculiar privilege; would they enable them to procure employment the readier, or even procure for them a higher standing in society? Would not only the result be, the solitary personal satisfaction of their possessing such a printed paper? A blacksmith would get no higher wages, or a better place, because he had passed an examination in Astronomy; nor a dry-goods clerk a situation the sooner

from his having passed a similar examination in Chemistry. To be sure, masters in both cases, should value these men more highly, not because their acquirements have any connection with their separate trades, but from the great probability that men who take delight in such subjects, would be more likely to be better workmen, and more steady and honest in their characters. But as masters do not look at it in this light, as no great degree of skill is valued or required in any trade in this country, or, I may fairly add, moral character either, I hold that it is but fair that the Board should offer some further inducement to submit to an examination than certificates.

It is no argument to say that certificates are offered, almost wholly, by the mother Institution at home. The case there is very different. The field and demand for superior skill and knowledge being there both large and great, the possessor of a certificate is pretty certain of bettering his position; and, as a natural consequence, the number of competitors is very large. Besides, if I am not mistaken, there are several branches of the government service there, open to candidates possessed of these certificates. While, more than all this, the home institution is well known and esteemed throughout the whole island, and the certificates are as much valued by the public as if they proceeded from an University.

How different the circumstances are in Canada I need not dwell upon. The institution here has yet to acquire a standing; the vast majority of the people of the Province being, I suppose, ignorant even of its very existence; nor are our government offices filled according to the acquirements of the candidates.

Taking all these circumstances into consideration, I am certain, Mr. Editor, you will agree with me when I say that it cannot be expected that candidates will come forward solely for certificates, and that if the Board wish to form annual examinations, they must offer something more substantial. It is but natural for a young man to expect something of real value as a reward for the labor required for qualifying for such an examination, and the trouble in attending it. The most convenient form for such a reward would, I suppose, be books, or small sums of money; and as it is not likely there would be many competitors for the first few years, $30 would probably cover the annual expense—a small consideration for the valuable results which such examinations would lead to. If the Board adopted such a plan, and gave timely notice of their intention to hold an examination with such prizes, I feel certain it would not have to regret again a similar failure to that of the present year.

Yours, truly, R. S.

Toronto, August 15, 1861.

[We cheerfully insert the above letter in the columns of the Journal, being satisfied that by keeping the subject before our readers, a spirit of enquiry will be fostered that will in the end result in the success of the proposed annual examinations of the Board.

Had our correspondent read the proceedings of the executive committee of the Board, published in the same number with the Report to which he refers in his letter, he would have noticed that what he considers the principal cause of failure for the present year, has been provided against for the future; the committee having offered a prize of ten dollars to each Institute establishing a class, of not less than six members, for the study of any of the subjects named in the programme for 1862, and submitting not less than two members of such class (who shall have passed a satisfactory previous examination by the local committee) for the final examination of the Board.

The managers of the several Institutes will no doubt award the ten dollars, appropriated by the Board, in prizes to the successful pupils of their respective classes; and as a further inducement to study, the Board will award silver medals at the final examinations, in addition to the certificates, in proportion of one to every five of the successful candidates.

While we cannot but believe that the prizes offered will tend to the success of the undertaking, we do not see that such should necessarily be the case. We believe that the certificates to be awarded by the Board will have a value in themselves which should be sufficient to induce the youth of our country to become competitors for them.

Our correspondent altogether underrates the advantages to the industrial classes of obtaining a knowledge of the subjects of examination, and asks if the possessors of these certificates will "enjoy any peculiar privileges."

Is it no advantage to the Mechanic that he is able to speak and write his native tongue correctly, or that he should have a knowledge of Arithmetic, Geometry, drawing, and the principles of Mechanics? to the Agriculturist or Gardener, that he be conversant with the science of his profession? to the Commercial clerk that he is a good penman, and thoroughly understands the principles of book-keeping? And to how many of the various callings of the Industrial classes, are a knowledge of one or more of the studies named in the programme of the utmost importance?

Where can the intelligent employer be found that will not appreciate an intelligent workman, or servant; and that will not pay more liberal wages to such as have their minds stored with knowledge, and whose characters for morality and industry have been established? We are satisfied that few such employers can be found.

The Board cannot look for that measure of success that has crowned the efforts of the London Society of Arts, nor can corresponding advantages be held out to the possessors of the certificates to be awarded; but a beginning must be made, and although the results may be small and not very satisfactory at first, yet, by perseverance, in the face of many discouragements, great benefits to the industrial classes may be confidently anticipated.—Ed. Journal.]

Selected Articles.

THE METALS IN CANADA.*

Lead.

The Geological Survey report the occurrence of lead in many localities in Canada. The following extracts from Sir William Logan's Reports of Progress will conclusively show to any one at all acquainted with the subject, that rich and persistent deposits of lead may be looked for in the townships of Bedford and Lansdowne, counties of Frontenac and Leeds.

In the Report for 1858, pp. 48–50, he says under the head:

" *Galena.*—This ore of lead is another of the minerals that are to be looked for in connection with the limestones of the Laurentian series, but it is not yet determined whether it specially characterises one or more of the bands. None of it was met with in the calcareous exposures in the district of the Rouge; but I have been informed that several veins holding galena have recently been discovered in the township of Bedford, not very far removed from those lodes which have already been discovered by Mr. Murray, in the twenty-first lot; and near the line between the eighteen and nineteen lots of the eight range of the township."

In the Report for 1851–52, Mr. Murray makes mention of the occurrence, in the second lot of the eighth range of Lansdowne, of a vein of heavy-spar and calc-spar cutting rocks of the Laurentian series, and holding disseminated crystals of galena, which had been unsuccessfully tried as a lead mine. Subsequently to his visit to the locality, a lode was discovered on the third lot of the same range, from which specimens were obtained in 1855 for the Paris Exhibition.

A trial shaft was sunk on it to the depth, it was said, of fifty feet, and a sufficient quantity of ore obtained to pay the expenses of sinking. The specimens showed a thickness of between two and three inches of pure galena, associated with calc-spar. It was said that other lodes existed in the neighbourhood, but their position was kept secret.

"The bearings given by Mr. Murray to the three lodes examined by him in Bedford are N. 15 W., N. 32 W., and N. 85 W., the last being the course of the lode traced and tested farthest. The distance between the Bedford and Lansdowne lodes is not much over twenty miles; and considering the differences that may be allowed for the gentle windings which usually exist in the courses of metalliferous veins, it appears not at all improbable that the lodes of the two localities may be identical or belong to one group, the bearing of the two positions being about N. 68 W. and S. 68 E. of one another. If a line from the Bedford to the Lansdowne lodes were continued twenty-five miles farther, it would cross the St. Lawrence and strike Rossie in Lawrence County, New York: where a group of well known veins of lead ore exists, some of which, though just now abandoned, are not supposed to be exhausted, and two of which are known at one period to have yielded a great quantity of ore.

"The rock cut by the lodes at Rossie is of the Laurentian series; but a line between Rossie and Lansdowne would intersect the outcrop of the Potsdam sandstone, which lies between Rossie and the St. Lawrence. It has been ascertained that a vein of lead ore cuts through this sandstone at Redwood, which would not be far from the position of the line to Lansdowne. It is thus not improbable that there is a group of lead ores running from Rossie to Bedford, and this metalliferous line appears well worthy the attention of explorers in search of lead ores. The dislocations in which the lodes exist are of course thus proved to be of more recent age than the Potsdam sandstone, but this by no means establishes that the older rock may not be the source of the metal."

Ramsay Lead Mine.—In 1853, Mr. Richardson ascertained the existence of a vein of galena on the third lot of the sixth range of Ramsay, in the county of Lanark. The rock which the vein intersects is an arenaceous limestone, the fossils of which prove it to belong to that division of the Lower Silurian series known as the Calciferous sandrock. Mining operations have been prosecuted with some success, and have established beyond a doubt the important facts that the galena occurs in true veins which may be depended on for persistance in depth, and that its quality is most excellent, producing eighty per cent. of metallic lead. "There appear," says Sir William Logan, "to be indications of other lodes with nearly the same bearing as the one opened at Ramsay, not far removed from it, and it may belong to a group which, running parallel with the Bedford and Rossie group, would be about forty miles from it to the north-east."*

Sir William in 1848 discovered traces of galena at Bay St. Paul, on the north bank of the St. Lawrence, about 90 miles below Quebec. Although in unworkable quantity, the mode of occurrence of the ore gave unmistakeable evidence of its being in a true vein; and, from the well known valuable characteristics of such deposits, this circumstance invests the discovery with some importance.

Galena of an excellent quality is known to exist at several points in the Quebec group of rocks, stretching from Lake Champlain to Gaspé but the facts have not yet been accurately ascertained by the compilers.

Gold.

Discoveries of gold have been made at several localities, and in fair quantity in Eastern Canada, chiefly in the valleys of the rivers Chaudiere and Du Loup, and their tributaries, and on the St. Francis, all in the Eastern Townships. In all cases it has been obtained by a laborious process of washing or *stream-work*, the material subjected to this process consisting of drift clay and gravel, the debris of the rocks, on which they repose. These rocks consist of clay-slates, and interstratified grey sandstones associated with conglomerates, talcose slate and serpentine, and with various ores of iron; and it seems probable from recent observations, that the gold producing regions will have the same geographical limits as those assigned to the Quebec group of rocks.* The gold has nowhere been found in place,

* From "The Metals in Canada," by Messrs Wilton and Robb, Montreal, 1861.

* Report of Progress for 1858, page 51.

* The Quebec group consisting of altered and highly dislocated and disturbed limestone and sandstone strata, belonging to the Lower Silurian system; and extends in a belt varying from twenty to sixty miles wide, from the borders of Lake Champlain eastward to nearly the extreme point of Gaspé. This band of rock is pronounced by Sir Wm. Logan, J. D. Whitney and other eminent geologists, to be a portion of the great metalliferous formation of North America; to

with the exception of a mere trace discovered in a quartz vein near Sherbrooke. The size of the largest nuggets varies from two to four ounces.

The result of the washings on the Du Loup and Chaudière in 1851–52, when the process was vigorously and systematically pursued during a whole season, was about 1900 dwts.; and the proceeds shewed a yield of about double wages. The quantity obtained was not so great, nor the results, as far as regards profitable working, so satisfactory as to give much encouragement to the gold seeker in Canada ; but it is fair to infer that since the rocks of the country are *now* ascertained to be identical with those which, in the neighbouring States, have yielded a considerable amout of the precious metal, explorations will be undertaken and prosecuted with greater vigor and greater prospects of success. On the whole however, it may not be considered out of place to repeat the caution given by Sir William Logan, that in all probability, "*the deposit will not in general remunerate* UNSKILLED *labour, and that agriculturists and others engaged in the ordinary occupations of the country, would only lose their labour, by turning gold hunters.*"

Silver.

With reference to the occurrence of this metal in Canada, we are not aware of the existence of any silver ores proper; and the lead ores which have been hitherto discovered are for the most part exceedingly poor in silver. Mr. Hunt however, in the Report for 1853, page 370, gives details of assays made by him upon samples of galena from Meredith's location (Maimanse) on Lake Superior, and from the Rapids of the Chaudière in Lower Canada, the former yielding thirty ounces, and the latter twenty five ounces per ton of metalic lead. This result affords the strongest encouragement to the prosecution of the search for argentiferous lead ores in these districts, which, although widely separated geographically, have been lately ascertained to belong to the same geological epoch.

On the north shore of Lake Superior, and in Michipicoten Island, considerable amounts of native silver have been obtained associated with copper veins and native copper.

At Prince's location, towards the western extremity of the Lake, 15 miles west of Sturgeon bay, a bunch of four cwt. of ore containing about four per cent of silver, with traces of gold, has been found. On the south shore in Michigan, which is considered to be in the same geological formation, a considerable amount of native silver is frequently met with, in workings for copper; but in most instances it is stolen, or deemed a perquisite by the miners; one nugget is mentioned by Whitney which weighed 96.8 oz.

Copper.

Although iron ores are most extensively distributed, and lead veins have been detected in the Laurentian rocks, we are not aware of any discoveries of copper in the region occupied by the great mass of this formation. This region has, however, been so little explored that it would be altogether premature to assert the absence of this metal. At various points along the lines of junction or contact between the Laurentian and the next succeeding formations, namely the Huronian in the west and Zower Silurian in the east, important discoveries of copper have been made.

Lake Region.—In the lake region the disturbances are so great, and the amount of exploration hitherto accomplished so limited, that it is impossible to indicate accurately the geographical boundaries of the formations; but the recent observations of Mr. Murray seem to point to this geological horizon as a promising field. In his Report for 1856, he says, referring to districts overlying this point in the series, "The existence of the ores of copper and iron, which are known to be more or less characteristic of the Huronian series of rocks, invests the geographical distribution of the formation with much economic importance. These ores were repeatedly observed in the region explored last season, and although nowhere seen in large amount or to a great extent, the indications were sufficient to establish their pretty general distribution. Small specks and patches of the yellow sulphuret of copper was frequently found in the blackish and dark grey slates on the lower lakes of the Maskinongi; and at the southern turn of these lakes there is a quartz vein of from six to eight feet wide, with copper pyrites cutting slate conglomerates, and an intrusive mast of compact flesh-red feldspar. In the feldspathic dyke, small narrow veins of speculiar iron ore occur, which appear to run parallel with the dyke or slightly oblique to it, and the quartz veins and its subordinate *droppers* cut across both. Were this vein as conveniently situated as those of somewhat similar character on Lake Huron, it is fully as well worthy of trial as many that were selected by explorers there some years ago upon which to found claims for mining locations."

In the Report for 1857, he says, "Copper pyrites is very generally disseminated through masses of greenstone wherever they were examined, and it occasionally appears in quartz veins in sufficient abundance to constitute metalliferous lodes. The most favorable indication known of this description is the area on the south side of Echo Lake, and in the hills north of the mouth of Root River, both of which localities have been taken up for the purpose of mining, but have not hitherto been worked to advantage."

Again, in the Report for 1858, Mr. Murray gives, a list of all the localities where copper ores were found on the River Mississagui; and in reference to it states that "though the quantity of the ore does not in the case of any of the veins appear very encouraging, they may become the means leading to the discovery of veins of a more promising character in the neighbourhood." A useful hint to the explorer will be found embodied in a further statement made by Mr. Murray in reference to the same locality, "The examination of the area connected with the Mississagui has not yet been sufficiently extended to determine the relations between the copper-bearing veins of the Grand Portage and the physical form to which they are subordinate. The veins of the lower part of the river are evidently related to the anticlinal existing there. Those of the south part of Echo Lake also belong to an anticlinal; so do those of the Bruce and Wellington mines; and it would almost appear as if the importance of the metalliferous indications rose with the sharpness of the fold. But whatever be the cause of the dislocations in which

which belongs not only the rich ores of Lake Superior, but the gold, silver, lead, zinc, copper, cobalt, nickel, chrome and titanium, found along the Appallachian chain from Canada to Georgia, as also in Missouri and Tennesee.

metalliferous minerals are secreted, it would seem to be a probable supposition that in a metalliferous district the greater the dislocations, the greater the chances of valuable metalliferous lodes."

The Huronian system itself occupies the whole northern flank of Lake Huron and parts of Lake Superior, and constitutes the lower copper-bearing rocks of the Lake region,—consisting of white and often vitreous sandstone or quartzite, passing into a jasper conglomerate and interstratified with heavy masses of trap. The deposits exist in the form of true veins, although it is said that some of the lodes have become rather poor and thin on penetrating to a comparatively small depth. The ores are entirely sulphurets,—yellow, variegated and vitreous,—no native copper being found in this region. The Wallace, Bruce and Wellington mines have been worked in this formation for many years: of these the Bruce mines are the most important, and have been worked by the Montreal Mining Company with tolerable success; and had proper skill and discretion been exercised from the first in their management, they would undoubtedly have proved an excellent investment. These are truly valuable mines, and should produce largely.

The important copper deposits at Maimanse, Michipicoten Island, and the more Western localities of the north shore of Lake Superior, in all probability belong to the upper copper-bearing rocks; being the same as are exposed on the south shore, and have produced such extraordinary results.

The promontory of Maimanse consists of thick masses of quartzose sandstone and conglomerate, associated with amygdaloid trap and volcanic ash or tufa. The copper occurs in the amygdaloid trap both in the native state and as ore, the vein-stones being principally calc-spar and quartz; the deposits seem to partake of the character of segregated veins, and are both very thin and do not hold out in depth, though exceedingly rich in some places. In 1855, at the depth of eighteen feet, a mass of native copper weighing 630 lbs. was extracted, and the whole yield of a shaft twenty-seven feet deep and without galleries was about three tons of metallic copper.

On Michipicoten Island, where copper mining has been carried on for many years, the metal is deposited in the native state in beds of amygdaloid trap and volcanic ash, overlaid by compact trap and underlaid by a coarse red quartzose sandstone; the cupriferous bed proper being from one to two feet thick, and sufficiently rich to pay for working. The metal also pervades to some extent the rocks lying above and below the copper-bearing belt, being distributed through the former in bunches, and through the latter disseminated in grains. It occurs also in veins traversing the beds at nearly right angles. It seems that when a metalliferous belt has been broken up by the intrusion of igneous rocks and re-arranged under metamorphic action, rich deposits of ore may be expected.

At the western locations on Lake Superior, the rocks consist of argillaceous shales or slates overlaid by a flow of trap; both formations being cut by numerous parallel trap dykes, and by transverse veins of quartz, barytes and calc-spar, carrying ores of copper and native copper. We are not aware of the extent to which these veins have proved productive. The amazing development reached by the copper workings on the south shore, situated in corresponding positions, will be best judged by the fact that in 1850 the aggregate value of exports was $266,000, while in 1860 it had attained the sum of $3,000,000. Masses of nearly pure native copper have been there discovered weighing from 300 to 400 tons.

Copper in Lower Canada.—We have already remarked that the Quebec group of rocks are the equivalents of the upper copper-bearing rocks of Lake Superior; and accordingly we find them characterised by similar features, as regards their metallic contents. Towards the line of junction between the Laurentian rocks and the Quebec group of the Lower Silurian system a few discoveries of copper ore have been made and recorded by the Provincial Geologists. In the Report for 1852–53, Sir William Logan states that in the seigniory of La-Norraye, in the county of Berthier, on the north side of the St. Lawrence, a point situated in the above geological horizon, a vein of calc-spar and pearl-spar occurs carrying copper pyrites, though in small quantity. He remarks that "though the vein does not appear by any means a promising one, it yet bears too many of the characteristics of a regular lode to be passed over without notice." Recently a report, which however wants confirmation, has been made of an important discovery of copper ore at St Irenée de Malbaie, which as will be seen by reference to the Report for 1849–50, is also situated at this point in the geological series.

In this connection also we have shortly to notice the discovery as related by Mr. Murray, (Report 1851–52, of a small quantity of copper pyrites occuring in a vein of calc spar which is found penetrating the Laurentian limestone and Potsdam sandstone, in the township of Bastard, county of Leeds. The vein was tried by sinking a shaft to the depth of twenty feet on it, but the amount of ore found was not sufficient to justify the expectation of a favorable result. The trial seems to have been made in consequence of the previous discovery, on Gananoque Lake near the same locality, of some loose mases of very fine and rich copper pyrites of considerable size, and containing upwards of thirty per cent of copper. The source of these masses has not yet been discovered.

In the same neighbourhood in the township of Escott, and still upon the borders of the Laurentian rocks, there occurs a *bed* of magnetic oxyde of iron, holding a considerable quantity of copper pyrites so strongly resembling the detached masses found on Gananoque Lake as to induce the belief that they have originated in similar deposits.* The cupriferous portion of the bed varied from six to ten inches in thickness over a length of about twelve feet extending in the direction of the stratification. Sir William remarks: I understand that between eighteen and twenty tons of the copper ore were obtained, but after this bunch became exhausted I believe no excavation was made through the dead ground in search of a further quantity. On testing the iron pyrites, Mr. Hunt has detected in it traces of cobalt, and as cobalt and nickel very generally accompany one another, the latter may very reasonably be expected in this deposit."

Copper in the Eastern Townships.—But the copper region of Eastern Canada, *par excellence*, will be found to be on the south side of the St. Lawrence in the Quebec group of rocks. So far as hitherto dis-

* See Report of Progress for 1858, p. 52.

covered, the deposits occur most abundantly and in greatest richness, as might be expected, in the highly altered and disturbed strata constituting the mountainous and picturesque region of the Eastern Townships. Throughout this region and extending as far as the extremity of Gaspé, the rocks are distributed in long narrow synclinal forms, with many sharp plications or folds, and in some cases overturn dips. The ores, consisting of the pyritous and variegated sulphurets of copper, are found usually in the vicinity of certain bands of dolomite, serpentine, soapstone and other magnesian rocks; and the deposits, in every instance yet discovered, preserve a direction coinciding with the stratification.

Upton.—In a trial excavation in the township of Upton, Drummond county, the ore, consisting of pure pyrites, in a matrix of calc-spar, occurred in the form of reticulating veins of from a quarter of an inch to an inch in thickness, enclosed in a partially crystalline limestome, the veins constituting bunches, several of which could be traced in the strike of the limestone, Sir William Logan regards them as veins of segregation, filling up fissures which do not pass beyond the limits of the limestone.

The same calcareous band, is traceable through several townships in a north-easterly direction parallel with the mountain ranges; and transversely to this course, a series of ridges nearly parallel to the first, are produced by repeated folding of the strata into synclinal and anticlinal forms; at many points in this series copper ore has been found under the same circumstances as at Upton. "The ore is very irregularly distributed in bunches, some of which might produce five, and others two to three hundred weights of between twenty and thirty per cent. to a fathom of ground; but the irregularities appear to be so great as to make it questionable if the ore is capable of being profitably mined."

Acton.—A very remarkable exception however occurs in the rich deposit forming the well known "*Acton Mine*" in Bagot county, an admirable description of which will be found in Sir William Logan's Report for 1858, to which we must refer our readers; as well as to an interesting and lively sketch of the same locality in the "Canadian Naturalist and Geologist," Vol. V.

In this case the greater proportion of the ore is deposited in brecciated masses or conglomerate beds, the pebbles being limestone, partly angular and partly rounded, and the paste consisting of the variegated and vitreous sulphurets of copper; the beds in question being subordinate to the stratification of the limestone rocks of the country. Many examples of similar brecciated bunches occur in the true veins of Cornwall and Devonshire, in England, as related by De La Beche,* and Sir William Logan states that the whole conditions of the case bear a striking resemblance to those of the copper deposits of the Ural Mountains, as described by Sir Roderick Murchison.

Referring to the Acton deposits, Sir William Logan says: "There is no doubt the mass of ore is a very important one; already after but nine weeks working not far from 300 tons have been housed, supposed to contain about 30 per cent of pure metal. The value of this quantity would be about $45,000; while inclusive of lordship, the mining expenses and those necessary to carry the ore to a market will be comparatively small. The quantity of ore excavated seems to have produced but a moderate impression on the total mass in sight." Since the above was written additional masses of ore are said to have been discovered at the same locality, and the working has been equally successful.

Leeds, &c.—In the townships of Inverness and Leeds, Megantic county, copper ore has been discovered at several points, in a different form from any we have hitherto noticed, and mining operations are there carried on with much vigour and skill. The ore occurs in rocks of an aluminous and micaceous nature, most appropriately named by Mr. Hunt "nacreous" (or pearly) slates; it is of the same description as that found at Acton, but is distributed in a succession of slate bed coinciding with the stratification, and also in quartz courses or veins crossing the strata at various angles. "The mode" says Sir William Logan "in which the copper ore is distributed in the nacreous slates of Leeds precisely resemble that in which it occurs in the bituminous slates of Germany; and it is only the circumstance that the facts known in connection with the Canadian deposits are yet too few to give entire confidence in the persistence of similar conditions over a great area, which should moderate expectation of an important result."

Sir William estimates the average yield of metallic copper from the Leeds beds at about four per cent. The copper-bearing slates of Mansfeldt in Germany, above referred to, are profitably worked on a yield of only two per cent; and the following remarks by Mr. Whitney in reference to somewhat similar circumstances are deserving of attention. Speaking of one of the workings on Keewanaw Point, Lake Superior, he says, "Here a bed of sandstone has been lately examined, carrying enough copper to be excellent stamp-work. By some it is believed that it carries *one per cent* of copper, but by others it is thought to be richer. It is perfectly clear from what can now be seen of it that many thousand tons of mixed rock and copper will be taken up from it in opening the mines. It will require no calcining to stamp and wash easily, and can be cheaply excavated. So little has been done in testing the value of the bed in question that great caution should be observed in giving an opinion in regard to it; but metalliferous beds have been and are now mined in the Ontonagon districts with some success, and on Portage Lake with prospects decidedly flattering."

MANUFACTURE OF PAPIER MACHE.

The origin of the manufacture of useful and ornamental articles from paper, is still a matter of doubt, although it is generally believed that the Japanese were the first inventors. From the name given to it, we would naturally infer that it had been introduced by the French; a recent French writer, however, ascribes the merit of producing paper ornaments to the English.

When the art of moulding and casting in plaster was first introduced into England, the art of preparing the pulp of paper was improved and extended, and ultimately rendered practicable the adoption of papier machè in the formation of architectural decorations. The handsome ceilings of Chesterfield

* Report on the Geology of Cornwall, Devon, &c., page 323.

House, and many of the fine old ceilings in deep relief of the Elizabethian era, are of this material.

The London *Ironmonger* gives the following description of the various processes practised in the manufacture of papier machè, at the works of Messrs. Loveridge & Shoolbred, at Wolverhampton:

"There are at present five principal varieties of *papier machè* known in the trade, viz., 1, sheets of paper pasted together upon models; 2, thick sheets or boards produced by pressing ordinary paper pulp between dies; 3, *fibrous slab*, which is made of the coarse varieties of fibre only, mixed with some earthy matter, and certain chemical agents introduced for the purpose of rendering the mass incombustible (a cementing size is added, and the whole well kneaded together with the aid of steam. The kneaded mass is passed repeatedly through iron rollers, which squeeze it out to a perfectly uniform thickness; it is then dried at a proper temperature); 4, *Carton pierre*, which is made of pulp or paper mixed with whiting and glue, pressed into plaster piece-molds, baked with paper, and, when sufficiently set, hardened by drying in a hot room; 5, *Martin's Ceramic papier machè*, a new composition, patented in 1858, which consists of paper pulp, rosin, glue, drying oil and sugar of lead, mixed in certain fixed proportions, and kneaded together; this composition is extremely plastic, and may be worked, pressed or moulded into any required form. It may be preserved in this plastic condition for several months, by keeping the air away and occasionally kneading the mass.

"The first mentioned variety of *papier machè* alone engages our attention here. A special kind of paper, of a porous texture, is manufactured for this purpose. An iron mould of somewhat smaller size than the object required, is greased with Russian tallow, a sheet of the paper is laid on to the greased surface of the mould, and covered over with a coat of paste made of the best biscuit flour and glue, which is spread evenly all over the sheet with the hands; another sheet is then laid on, and rubbed down evenly, so that the two sheets are closely pasted together at all points. After this the mould is taken to the drying chamber, where it is exposed to a temperature of about 120°; when quite dry, which it takes several hours to accomplish, it is carried back to the pasting-room, and another sheet laid on with another coat of paste, after which it is returned to the drying chamber, and the same operation is repeated over and over again until sufficient thickness is attained, which, for superior articles, such as are manufactured at these works, requires from thirty to forty sheets of paper, and of course as many coats of paste between. The shell is then removed from the mould, and planed to shape with a carpenter's plane, after which it is dipped in linseed oil and spirits of tar to harden it; this changes the color from gray to a dingy yellowish-brown tint. The article is then stoved, and seven or eight coats of varnish are laid on (with a stoving after each), which are cleared off each time, any inequalities of surface being finally removed with pumice-stone. The number of drying processes the articles have to go through consume so much time that it takes three or four weeks to fit them for ornamentation, which is applied in bronze-powder, gold or color, and for many articles also in mother-of-pearl. The ornamentation of these articles is sometimes effected in the highest style of the painter's art. It was in Wolverhampton that Bird, R.A., worked as a 'japanner,' the technical name given to an 'ornamentor;' and we believe some other of our great artists have sprung from the pursuit of this occupation.

"The gold-leaf is laid on with a solution of isinglass in water, the design then pencilled on with asphaltum, the superfluous gold removed with a dossil of cotton dipped in water, which leaves intact the parts touched with asphaltum, and the latter finally removed with essence of turpentine. The cotton pledgets used are of course carefully collected, to recover the gold removed by them.

"After the application of every coat of color or varnish, the object so colored or varnished is dried in an oven or chamber, called a stove, and heated by flues to as high a temperature as can safely be employed without injuring the articles, or causing the varnish to blister. All articles so japanned, or, to use the technical term, 'stoved,' are more durable than they would be if simply left to dry in the air.

"For black grounds, drop ivory-black mixed with dark colored animé varnish is used; for colored grounds the ordinary painter's colors, ground with linseed oil or turpentine, and mixed with animé varnish. The colors most in use are white lead, cobalt blue, yellow, vermillion (used more particularly to imitate tortoise-shell), Indian red, verdigris, umber, and the intermediate tints produced by mixing two or several of them together. The varnishes most used are aminé and copal. The grounds and varnishes are generally laid on with painting brushes, or flat brushes, made of fine soft bristles. Tin-plate articles intended for japanning, are first thoroughly cleansed from every trace of grease that may adhere to them, with turpentine or spirits of tar, then rubbed with sand-paper. They are then ready to receive the first coat, after which they are thoroughly dried in the stove.

"For black japanned works, the ground is prepared with a coating of black made as just now stated, by mixing drop ivory-black with dark-colored animé varnish, which gives a blacker surface than would be produced by the japan alone; and the object is then dried in the stove; from three to six coats of japan are afterwards successively applied, the work being always thoroughly dried again in the stove ovens between the laying on of every fresh coat.

"For brown japanned works, umber is mixed with the japan, to give the required tint; the process in all other respects being the same as for black japanned works.

"The colors are protected against atmospheric influences, and made to shine with greater brilliancy, by two or three coats of copal or animé varnish. Superior articles receive as many as five or six coats of varnish, and are finally polished.

"The ornamentation of all such articles as come under the head of toilet wares, is effected by the ordinary mode of painting with a camel's hair pencil, or some fitting substitute; where imitations of woods or marble is intended, the ordinary grainer's tools are used. Many patterns are produced upon the various articles by 'transfer printing.'"

SUPERHEATING STEAM IN LOCOMOTIVES.

The Toronto *Daily Leader*, of Tuesday, Sept. 3rd, in an article on the working of the locomotives on the Grand Trunk Railway of Canada, speaks of Mr. Martin, the Locomotive Superintendent of the Western Division, and of his recently patented super-heating apparatus, as follows:

"This gentleman, whose experience has extended over a period of eighteen years, has devoted a great deal of attention to the improvement of the locomotive, with especial reference to the saving of fuel; and a visit to the Toronto workshops enables us to state the shape and the result of his labors in this direction.

"Fully alive to the drawbacks to the highly expansive

working of the locomotive which arise from condensation, and the large quantity of water which is carried with the steam into the cylinders, causing loss of power by back pressure, Mr. Martin has brought into use a superheating apparatus, which, after severe and protracted trials, is found to work admirably. The value of the superheating process, as applied to marine engines, has long been known; but though the most eminent writers on this branch of engineering have repeatedly dwelt upon the desirableness of applying the process to the locomotive, the object aimed at has not hitherto been attained. Amongst those who have dwelt upon the subject most emphatically, is Mr. Kinnear Clarke, perhaps the ablest and most widely known writer on railway machinery, and who has just been appointed by the English Commissioners Superintendent of Machinery in the approaching Exhibition. For though superheaters have been tried in the smoke-box of the locomotive on other railways, they have virtually been failures; an inability to prevent the choking of the draft producing an aggravation of the very evil which engineers have desired to remedy. To Mr. Martin belongs the credit of having perfected an invention which realizes the great desideratum—a diminished consumption of fuel—and yet avoids the drawbacks which have baffled other inventors.

"An examination of the working returns of near a score of engines, running on the Grand Trunk Railway, shows that in no instance has Mr. Martin's superheater failed to improve the engine, as well in actual hauling power as in steaming qualities. It is impossible, without diagrams, to illustrate the construction and working of the apparatus. We may nevertheless be understood by mechanics, when we say that inasmuch as the position of the bottom of the superheater acts as a vacuum-chamber, an equalization of the draft is secured, and there is consequently always an abundance of steam. The economical result is remarkable. In some engines, where the smoke-box was sufficiently capacious to admit of the largest superheater, a saving of thirty per cent. has been effected. Mr. Martin is modest, however, and contents himself with claiming on the average a saving of twenty per cent.; a reduction in the outlay upon fuel which railway managers will know how to appreciate. As a natural result, the quantity of water consumed is largely diminished. We may mention that the saving effected by the superheater is rendered all the more noticeable by the fact, that the engines furnished with the apparatus were originally fitted with the American Petticot pipe, which is admitted to be a good equalizer of the draft.

"The superheaters used on the Grand Trunk are usually made of cast iron, three-eighths of an inch in thickness, with wrought iron tubes of sixteen wire gauge. Some are of copper, with copper tubes. No ferules are employed. The steam pipes are joined with the loose brass ring used in ordinary practice; and although some of the engines, with the apparatus, have run two years, no trouble has been experienced from leaky joints or tubes, or in the working of the valves or pistons. The cost of the apparatus, when applied to a number of engines, is, we learn, $75 per set. And to secnre to himself the profit of his invention, Mr. Martin has taken out patents in this Province, in the United States, and in England and France."

INKS.

Indestructible Ink.—1. Powdered copal 25 parts; oil of lavender 200 parts; lamp-black 2 parts; indigo 1 part. Dissolve.

2. Asphaltum 1 part; lamp-black ¼ part. Melt, then add oil prepared for printers' ink, by boiling and burning until sufficiently stringy, 1½ part. Mix together, and add spirits of turpentine 3 or 4 parts. We would propose this ink, made with less turpentine, so as to be sufficiently thick for stamping, as the most perfect preventive of fraud, as when applied to the surface of an engraving, or letter-press, nothing will remove it that will not also discharge the ink of the stamp. It will stand the action of the alkalies, chlorine, acids, &c., even in a heated state, when they will at once destroy the texture of the paper.

Lithographic Ink.—1. Take Venice turpentine 1 part; lamp-black 2 parts; tallow 6 parts; hard tallow soap 6 parts; mastic in tears 8 parts; shellac 12 parts; wax 16 parts. Melt, and pour it out on a slab.

2. Take dry tallow soap 5 parts; mastic in tears 5 parts; Scotch soda 5 parts; shell-lac 25 parts; lamp-black 2 parts. Fuse the soap and lac, then add the remainder.

For use, this ink must be rubbed down with water in a saucer (warmed), until an emulsion is formed of a proper consistence to flow easily from a pen or pencil.

Blue Writing Fluid.—1. Ferrocyanide of iron, powdered, and strong hydrochloric acid, each 2 parts. Dissolve, and dilute with soft water.

2. *Indestructible.*—Shell-lac 4 parts; borax 2 parts; soft water 36 parts; boil in a close vessel till dissolved: then filter, and take of gum-arabic 2 parts; soft water 4 parts. Dissolve, and mix the two solutions together, and boil for five minutes as before, occasionally stirring to promote their union; when cold, add a sufficient quantity of finely powdered indigo and lamp-black to color; lastly, let it stand for two or three hours, until the coarser powder has subsided, and bottle for use. Use this fluid with a clean pen, and keep it in glass or earthen inkstands, as many substances will decompose it while in the liquid state. When dry, it will resist the action of water, oil, turpentine, alcohol, diluted sulphuric acid, diluted hydrochloric acid, oxalic acid, chlorine, and the caustic alkalies and alkaline earths.

Red Ink for writing.—Boil over a slow fire 4 ounces of Brazil wood, in small raspings or chips, in a quart of water, till a third part of the water is evaporated. Add during the boiling 2 drachms of alum in powder. When the ink is cold steam it through a fine cloth. Vinegar or stale urine is often used instead of water. In case of using water adding a very small quantity of sal-ammoniac would improve this ink.

Fine Black Writing Ink.—Take 2 gallons of a strong decoction of logwood, well strained, and then add 1½ pounds blue galls in coarse powder; 6 ounces sulphate of iron; 1 ounce acetate of copper; 6 ounces of well ground sugar; and 12 ounces of gum arabic. Set the above on the fire until it begins to boil, then set it away until it has acquired the desired black.

Black Ink Improved.—To 1 pint of common black Ink add 1 drachm of impure carbonate of potassa, and in a few minutes it will be a jet black. Be careful that the ink does not run over, during the effervescence caused by the potassa.

Green Ink.—1. Cream of tartar 1 part; verdigris 2 parts; water 8 parts. Boil until reduced to a proper color.

2. Crystallized acetate of copper 1 ounce; soft water 1 pint. Mix.

Marking Ink.—Lunar caustic 2 parts; sap green and gum-arabic each 1 part; distilled water. Dissolve.

The preparation.—Soda 1 ounce; water 1 pint; sap green ½ drachm. Dissolve, and wet the linen (where you intend to write) with this mordant, then well dry it.

Miscellaneous.

Ship Armor Plates.

The Sheffield and Rotheram Independent (English paper) describes the manufacture of armor plates for the war vessels of the British navy as conducted upon a large scale at one of the iron and steel establishments in Sheffield. The plates are made from slabs of bar iron, each 1½ inches thick, and measuring 30 by 12 inches. Four of these are first laid upon one another and heated to a white heat in a furnace, then rolled into a plate about four feet square. Step by step several plates are now put together, heated and rolled until four plates measuring 10 feet by 4 feet 4 inches and 2½ inches thick are made; then these four are heated, welded together and rolled, by one final operation making one massive armor plate 20 feet long, 4 feet and 4 inches broad, 4½ inches thick and weighing 6 tons or 180 lbs. to the square foot. Formerly armor plates were forged by a huge steam hammer, but it has been found that by using iron of different fibres, and rolling it from slabs, so as to have about 132 layers, the plates are tougher than those formed by hammering.

When one of these huge plates are rolled finally it is quite crooked and has to be straightened. To do this it is placed on a long flat iron bed, and two immense rollers—each weighing nine tons—are passed over it, in the same manner as plate glass is made. This levels the plate perfectly, and it is now left to cool. The plates after this are each lifted by a crane into a huge planing table, where they are cut true on the edges to the exact width of four feet, then they are tongued and grooved like pine boards for flooring, and are ready to be bolted to the side of the vessel.

Electricity for Exploding Gunpowder.

In a recent lecture in London by Professor Abeel, F.R.S., and Director of the chemical establishment of the War Department, he stated that an extensive series of experiments had been made for ascertaining the different forms of electricity which were the most advantageous for exploding gunpowder. The Ruhmkorff coil, by which electricity of high tension is obtained, he considered was the best. What is called the "magnet fuse" has been used very successfully in firing gunpowder with electricity. It consists of two fine copper wires, each covered separately with gutta-percha, then both placed alongside, and bound together with an outer coating. It is then cut into short lengths, exposing the copper wires at the ends. Moistened gunpowder is placed upon the terminals or ends of these fuses when placed in the mine that is charged with powder to be exploded. A spark of inductive electricity sent from a Rhumkoff coil fires the moist gunpowder at the end of the fuse, and explodes the charge with certainty. This moistened gunpowder is prepared by mixing the fine-grained quality with a dilute alcoholic solution of chloride of calcium. A large supply of such fuses, with prepared gunpowder and a large magnetic apparatus for generating electricity, furnished a portion of the equipment of the British army during the late China war, and the obstructions to the expedition on the Peiho river were cleared away by electrical discharges.

An improvement in the magnet fuse has lately been made in rendering the priming composition more sensitive by using a mixture of phosphide and sulphide of copper and the chlorate of potash. This priming is put upon the terminals of the copper wire, and it is ignited with the smallest size of magneto-electric machines—such as the 6-inch horseshoe magnet and a rotating armature used in America for medical purposes.

The charges of powder which are used for blasting under water and in mines with electricity, are either inclosed in a tin case or a bag of india-rubber, with the magnetic fuse placed in the middle, and connected with the conducting wire to the magneto-electric machine which develops the sparks. For field and mining operations in military engineering, a magneto-electric machine is more convenient than a galvanic battery, and a very small apparatus, made with Beardslee's American cast iron radial magnets would, we think, answer admirably for such purposes.—*Scientific American.*

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to Industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURERS & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

OCTOBER, 1861.

THE PROVINCIAL EXHIBITION.

The history of the Provincial Association in its relation to our annual Provincial Exhibition is full of interest to Canadians. It is the narrative of the rise and progress of a national institution from which immense benefits have sprung, and many more are expected for a long series of years to come.

The Provincial Exhibition is one of the tests of our improvement in all that relates to material wealth and solid progress. It is an annual examination of the state of our industry, intelligence, activity and knowledge. It enables us to compare our condition as a people with that of other nations; to discover in what respect we fail to attain to the standard of excellence at which others have arrived; in what particulars we excel, and how we may best improve the natural advantages by which we are surrounded, and ameliorate the disadvantages which are inseparable from our geographical position.

No event of equal importance to the Provincial Exhibition occurs during the year in Canada, out of the field of politics; for good government stands at the head of all national interests, and the desire to be governed wisely and well is superior to all aspirations towards excellence in agriculture, art or mechanical skill.

Politics cannot be broached within the walls devoted to the objects of the Provincial Exhibition. All allusions in the annual addresses to subjects of a party or political nature are necessarily forbidden by tacit consent. Early in the history of the Provincial Association was the caution given by the Hon. Adam Fergusson, on the 22nd October, 1846, at Toronto, where the first Exhibition was held:—"I feel, gentlemen, far more intensely than I can possibly express, *that our very existence*, as a useful institution, must altogether depend upon a firm and scrupulous exclusion of all such topics from the Board. Thank God, we have a great and magnificent arena, upon which every man in Canada may contend, in honorable and patriotic competition, untainted by party jealousies or strife; and most devoutly should we all pray, that party feeling or party intrigue, may never be known amongst us."

The first Provincial Exhibition was held in Toronto, in October, 1846. It extended over two days. The whole amount offered in prizes reached nearly £400, and the number of entries were 1,150. Ten years later, the amount of prizes was £2,309, and the number of entries 3,791, or more than three times as many. It is curious and instructive to compare the thoughts and opinions of men at that period, based on what they saw around them, with the condition of things at the present day. The Hon. Chief Justice Robinson, now in the progress of events in Canada, where merit paves the way, Sir John Beverley Robinson, Bart., said at the first Exhibition, "There was no country possessing the advantages — advantages almost illimitable — that Canada does. Looking to the great waters at her feet, and the innumerable rivers leading thereto, and the water power afforded—he would ask, where was the country that could boast of like advantages with Upper Canada? Even with London and other towns far removed, the inhabitants had the advantages of good plank roads, by which the produce reached the great waters, on whose surface it was to be borne to Europe."

The Association began its existence boldly—it relied upon the country it was to serve. It has served it well, and well has it been sustained. It commenced its career wholly without funds, relying upon members' fees and on "contributions," particularly from County Societies, to enable it to pay the premiums offered by itself, and the expenses incurred in its own nourishment and growth.

In the second year of its existence, the annual Exhibition was held at Hamilton, when not less than 550 more entries were made than in the previous year, and premiums to the amount of £750 offered; but the Association found itself £300 in debt at the close of the year, but still full of hope. Col. E. W. Thompson, the President of the Association, a household name among farmers in Upper Canada, spoke in the annual address of the near completion of the internal water communications in the Province; but, he continued, "railroads, plank and macadamized roads must follow in every direction." He saw the necessity of progress—manufactures accompanying progress in agriculture—for he warned farmers of "the necessity of cultivating flax and hemp and the finer kinds of wool." Lord Elgin, with eloquence so natural to him, said of our country at that meeting: "Canada springs at once from the cradle into the full possession of the privileges of manhood. Canada, with youth's elasticity in her tread, has the advantage of all the experience of age. She may avail herself, not only of the capital accumulated in older countries, but also of those treasures of knowledge, which have been gathered up, by the labor and research of earnest and thoughtful men, throughout a series of generations."

When three years old, the Association determined to hold their Exhibition at Cobourg, and notwith-

standing their indebtedness, they offered prizes to the amount of £775, and extended the time the Exhibition was to last to four days. In a pecuniary point of view this Exhibition was successful, and the number of persons who visited the grounds was about 6,000.

Great improvement began to be visible at the fourth Exhibition, which was held at Kingston in September, 1849. Evidence of improvement in home manufactures began to be apparent. Agricultural implements were no longer only represented by fancy specimens from Rochester and elsewhere across the boundary line. Although our neighbours held their own, and indeed surpassed Canadian manufacturers, yet still there was great improvement visible, and it was evident to all that the annual Exhibitions were taking hold on the people and producing good results. The tree had only begun to blossom, but the show of fruit was good and promised well.

Mr. Sheriff Ruttan, who is one of the oldest born of this country, and who has seen it rise from a wilderness wherein people starved if the wolves killed too many deer, to a wealthy Province, exporting its sixteen million bushels of wheat, and numbering over a million and a quarter industrious inhabitants, said in his address, which he delivered in 1849, "We must *henceforth* encourage all sorts of manufactories throughout the country, and until we can be thence supplied, set a-going within our own dwellings the old-fashioned spinning wheel and loom. We must, male and female, wear our own manufactures."

The year 1850 ought to have been expressly distinguished by progress—it was the year before the great International Exhibition at London. The Provincial Exhibition was held at Niagara. The prizes offered amounted in value to £1,276, and the results were particularly satisfactory. This year will be celebrated in the agricultural annals of the country by the establishment of the Board of Agriculture, which became a corporate body by act of Parliament on the 10th August, 1850. In 1851 the Board was organized, and the names of the elected members published in the *Canada Gazette*. They were E. W. Thomson, Esq., Hon. Adam Fergusson, Henry Ruttan, Esq., R. L. Denison, Esq., David Christie, Esq., J. B. Marks, Esq., John Harland, Esq., the Hon. Inspector General, and the Professor of Agriculture in the University of Toronto.

Brockville was the next place where it had been decided to hold the Exhibition for the year 1851. T. B. Marks, Esq., the President, saw what many began to see dimly, others more clearly, but did not deem it wise to express their views openly, that "the powerful influence of manufactures in increasing the population and wealth of a country is too certain and obvious to admit of doubt. They not only afford direct subsistence, and the means of attaining to affluence, to an immense number of individuals, but they act powerfully and beneficially on the agricultural and other classes,—supplying them with an infinite variety of useful and necessary accommodations at a low price. A flourishing agriculture greatly depends, in fact, upon flourishing manufacture." The foregoing sentence told much in few words. What would be the use of the most successful agriculture if there was no market for surplus produce? and if foreign markets failed, as they frequently do, what would the farmer do with his grain and stock if all had to sell and there was nobody to buy? The results of this Exhibition were not very favorable. Brockville is not situated in a good farming county of great extent. The entries, as well as the amount of the prizes awarded, were less than those of the preceding year; but the finances, chiefly in consequence of the Government grant, which in 1852 was increased from £500 to £1,000, were prosperous.

The seventh Exhibition was held at Toronto, on the site of the present magnificent building—the Toronto University. Here is another instance of the changes, rapid and most unexpected, which constantly occur in Canada. Where the products of the farm and the manufactures of Canada were exhibited in an open field, ten years ago, is erected the most splendid building in British America and one of the finest on this continent. The writer of this notice had an opportunity of describing the Exhibition at Toronto, in 1852, in the pages of the *Canadian Journal*.* It will not be out of place here to introduce a few brief extracts, to show how the progress of Canada then was considered something extraordinary and marvellous. We may compare it with our impressions of to-day, written at London, nine years since the Exhibition to which the quotations refer:—

"But few, perhaps, among the thirty thousand visitors to the Exhibition ground on Thursday, September 23rd, permitted their thoughts to wander back to the time when the spot, so densely occupied by the 'pale faces,' and crowded with their works of patient industry and skilful art, was a wild and marshy forest, tenanted only by a few wandering Messassaugas; or, at a later date, and in memory of numbers then present, the forest suburbs of a village, which numbered but a few hundred enterprising settlers.

"Sixty years ago, an Indian wigwam stood alone on the spot now occupied by a city containing thirty-two thousand inhabitants, and furnished with nearly all the requirements of modern civilization, and much of the energy and skill which characterizes the age.

* The *Canadian Journal*, first series, October, 1852.

"Sixty years ago, the population of Upper Canada consisted of a few thousand families, dispersed over a territory containing upwards of forty-six thousand square miles, enjoying but a very limited means of communication between themselves, and deriving few advantages from a chequered intercourse with the world beyond their own great lakes.

"At the time we write, this extensive Province [1] peopled with one million freemen, in possession of those civil and religious blessings which can alone be won and enjoyed by an enterprising and vigorous people."

The number of entries at this Exhibition was upwards of 3,000; the number of visitors computed at about 40,000, and the total expenditure amounted to £2,400.

In 1852 another change, greatly affecting the in terestso f agriculture and the mechanical arts in the Province, took place. A new department was added to the Provincial Government, under the designation of the "Bureau of Agriculture."

The object of the new governmental department was "to centralize and perfect, by means of the appointment of a member of the Executive Government specially charged with such duties, the system of organization under which Agricultural Societies, the Provincial Agricultural Association, and Boards of Agriculture, had been for some time in existence; to give these bodies, in both sections of the Province, a more direct means of communication with the Government; to increase the facilities for carrying out their objects, so as to produce more valuable results; and to afford to the Legislature, and to the Province generally, a ready means of ascertaining what those results were." The Hon. Malcolm Cameron was the first incumbent of this new office, under the title of "Minister of Agriculture."*

The eighth Provincial Exhibition was held in Hamilton. The whole amount of prizes offered was £1,602, being an increase of £130 on the previous year; the number of entries was 2,820. This Exhibition was considered as an improvement on that held at Toronto. The general display of mechanical work and of domestic manufactures was very good, showing both progress and confidence in home productions. The number of visitors was about 30,000. In the annual address, the senior Vice-President, Mr. Treadwell, who in the absence of the President, Mr. Matthie, was called upon to perform that duty, said: "Our railways have been located, and are in process of construction." Time and money have finished the work, and we are now reaping the benefits of those gigantic enterprises which at these earlier Exhibitions were only spoken of or slowly progressing.

In 1854 the Board ot Agriculture presented a report to the Government, in which they expressed their opinion of the character of the Provincial Exhibitions, and the use they had been to the country in the following words:—

"The last two Exhibitions, held at Toronto and Hamilton, respectively, were attended by a vast concourse of visitors; and not only were the stock and articles for competition much larger in amount than at previous shows, but several new things were introduced, and the general quality of the whole was of a higher character than heretofore. In implements and machinery a very marked improvement was obvious, and in the varied productions, adapted to a northern climate, it is believed that the Exhibitions of the Upper Canada Association are not excelled by any on this continent."

The year 1854 brought the ninth Exhibition to London. The site selected was the old Parade ground, about twenty-eight acres in extent. The influence of railways began now to be felt. The Great Western Railway Company offered to convey articles to and from the Exhibition free of charge. The influx of visitors was very great, and at one time it was stated that 25,000 persons were present,—while the total number of visitors was thought to be not less than at Hamilton and Toronto. The amount offered in prizes was £1,794, and the number of entries 2,933. The pecuniary condition of the Association was rapidly becoming more flourishing, the balance in hand, on the 21st Sept., 1854, being £1,332 14s. 4½d.

The tenth Exhibition was held at Cobourg. The prize list for 1855 amounted to £2,304, or about £520 more than had been offered at any previous Exhibition. In agricultural implements and domestic manufactures it fell short of its predecessors; but in the cattle department it was considered to be equal, if not superior, to any which had taken place on this continent. The President, David Christie, Esq., M.P.P., stated in the annual address that, "We think we can mark in each succeeding Exhibition unmistakable proofs of the rapid progress which Canada is making in the social scale. But such evidence is not confined to our Provincial Exhibitions. At the Industrial Exhibitions of London, New York and Paris, those great milestones in the pathway of the world's progress, the word 'Canada' is broadly marked."

The eleventh Exhibition was held at Kingston in September, 1856. Here the first permanent building for the purposes of the Association was erected. The Government granted a license of occupation for the term of twenty years on a part of the Penitentiary farm lot, of about twenty acres in area. Here the Local Committee erected a building of wood and glass. This structure is of the form of a Greek cross, the transepts being 190 feet long and 56 broad. The height of the cupola is 60 feet, but the general

* Transactions of the Board of Agriculture of Upper Canada, 1856.

height of the building not more than 34 feet. The grounds are enclosed with a permanent board fence. The entire expense of the building, offices, &c., amounted to £3,918. The number of entries at the Exhibition was upwards of 3,790. Agricultural implements, manufactures in metals, carriages, cabinet-ware, woollen goods and manufactures generally were well represented, and the entries considerably exceeded those of any former Exhibition. The amount offered in premiums was £2,309, but the amount awarded was only £1,699. This was owing, no doubt, to a large number of articles which were entered for Exhibition not having been sent in time.

The twelfth Exhibition was held at Brantford, on an area of about twenty acres, on which temporary buildings had been erected by the local committee. The amount of prizes was £2,517, and the number of entries reached 4,337. The agricultural implements were very well represented, being nearly double the number of those exhibited at either of the two previous Exhibitions. In manufactures of leather, furs, metals, &c., the entries were more numerous than in former years, but there was a falling off in woollen and flax goods.

The subject of having permanent buildings erected in suitable localities for the Exhibitions of the Associations was publicly discussed at a general meeting of members of the Association. At a banquet given to Sir William Eyre, the Administrator of the Government, and other distinguished guests, the Hon. P. M. Vankoughnet, Minister of Agriculture, very appropriately remarked that "the mechanical department of the Exhibition has justly attracted great consideration, and an exhibition of those articles is more interesting to many than the mere productions of the earth." "The importance of our agricultural interests could be no better exemplified than by the mixed display here shown, which proves just this, that from what was the first product of the laborer's toil have been built up those arts and manufactures, specimens of which are here exhibited." The Rev. Dr. McCaul thus described the condition of Canada in 1857: "A few years ago, the Chief Justice of Upper Canada stated that there were men then living—and it is possible that they may be still alive—who could remember the time when there was not a single cultivated farm within the limits of the Western Province. And what have we now, within the duration of human life? Millions of acres under cultivation, well-managed, well-stocked farms, rewarding the industry, the enterprise, and skill devoted to them—millions of bushels of wheat exported—our agricultural products worth millions of pounds sterling—some thousands of mills and other manufacturing establishments—large and populous and thriving cities, towns and villages, where formerly there were but tangled woods and dreary swamps—commerce spreading the sail or driving the paddle-wheel alike over the watery highway, that stretches from the far-off gulf of ocean to remote Superior, and over the smaller lakes that gem the interior of the country—and the whistle of the locomotive, heard above the hum of business, as it sweeps through our frontier towns, from the rocky fortress of the St. Lawrence to the grassy banks of the Detroit, or waking the echoes of the primæval forest, as it rushes far back beneath its leafy arches."

The Hon. George Alexander, M.L.C., the President of the Association, adverted in his address to the importance of fostering manufactures, giving due acknowledgment to the prior claim of agriculture:—

"But while Agriculture is and will continue to be our chief and leading interest, there are other objects which must enlist the enterprize of our people. The husbandman raises more than he can consume, while in this age of high civilization, he is the creature of a thousand wants. We must look to commerce and manufactures to supply those wants, and to give a marketable value to all our surplus produce. We must foster in every way those branches of industry which will give popula- to our towns and cities, secure to us a home market—*diminish the amount of our imports*, and consolidate our wealth. Canada has already been successful with her Foundries, Tanneries, Asheries, Soap, Chair, and Nail Factories, Cloth, Oil and Paper Mills.—Toronto, Hamilton, and Kingston, have produced their Locomotives, and Galt her highly finished edge tools; but she has done more, and it is with pride we chronicle the fact that Galt has exported to Australia during the present season, a steam engine and other manufactures.* There is a marked spirit of enterprise abroad in our country, and when we look at our noble St Lawrence and those great inland seas, which along with our railways afford such facilities for carrying on all our commercial exchanges—when we regard the boundless extent of water power—the certain local demand for all manufactured products—while we have territory that can sustain a dense and teeming population—I say that we cannot behold all this without feeling that our country presents an unlimited field for human enterprise."

The financial position of the Society still continued favorable; the amount received and paid by the Treasurer, R. L. Denison, Esq., reaching the very imposing sum of £13,799 16s. 6d., and the balance at the credit of the Association slightly exceeded £460.

In 1858 the thirteenth Exhibition was held in Toronto. An imposing permanent building was erected on a portion of the military reserve, ceded to the corporation by the Government, comprising

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* Messrs. James Crombie & Co., exported a 20 horse-power high pressure engine. Messrs. Wm. Quarry & Co., exported manufactured harness.

an area of about twenty acres. The local contributions towards the building were $20,000 from the City of Toronto, $4,000 from the County of York, and $800 from Agricultural Societies. The amount of prizes offered was about $11,000, and the number of entries reached 5,559, being over 1,200 more than at any previous Exhibition. The following description of the building was given in the local papers, at the time of laying the foundation-stone:—

"The building is situated upon 20 acres of ground suitably enclosed, and will afford exhibition space of 32,000 feet. It is to be built in the style of the English Exhibition of 1851. It will extend 256 feet in length, 144 in breadth, and will be 56 feet in height, the wings being so formed as to admit of subsequent extension if necessary. . 2,000 square feet of glass will be fixed upon the roof, and fully 6,000 feet below. The glass will be of the rough-rolled plate description, manufactured expressly in England, being for the sides one-eight of an inch in thichness, and for the roof one-sixteenth of an inch thicker. The gross weight of the glass will be 12 tons. It is worthy of mention that the roof has been adapted to the climate. There are no gutters, as gutters if broken when frozen would have a tendency to burst the framework, and in a year or two destroy the building. The circular portion of the roof will be covered with tin. The castings were all made by the Messrs. Hamilton & Sons, at the St. Lawrence Foundry, in this city. The contractors' cost of the building will amount to £4,878. To assure perfect safety the girders have been tested to a strain of double the pressure to which they can by any possibility be subjected, and are calculated to bear five times the ordinary strain of pressure."

At the ceremony of laying the foundation-stone, Col. Thompson, President of the Board of Agriculture, said: "As to the objects of the Exhibition, they were intended not only to advance the interests of agriculture, but also to encourage arts and manufactures. The Society was anxious that arts and manufactures should advance equally with agriculture. By agriculture alone a country could never become wealthy. It must also have trade and commerce and manufactures combined with agriculture."

The thirteenth Exhibition was inaugurated with unusual ceremonies. The Metropolitan Choral Society, composed of 250 vocal and instrumental performers, officiated with great success. Prayers were offered up by the Lord Bishop of Toronto; and an address was presented to His Excellency Sir Edmund W. Head, Bart., Governor General.

The Rev. John McCaul, LL.D., President of University College, delivered an excellent address in the Exhibition building, which, by the way, has very erroneously been called "The Crystal Palace," on "The state of Agriculture amongst the Romans."

The President of the Association, D. B. Stevenson, Esq., was unfortunately unable to assume the duties of his office on account of continued ill health. His place was supplied by W. Ferguson, Esq., the first Vice-President, who dwelt upon the manufacturing interest of the Province to a greater length than any of his predecessors. The subjoined extracts will explain the views entertained by that gentleman, and we should be glad to see other members of the Board of Agriculture more thoroughly imbued with the spirit they embody:—

"It may be alleged that this country is not sufficiently advanced, to require or maintain manufacturing on an extensive scale; and that the reclaiming of our forests, and a better cultivation of our cleared lands, should for many years be our chief object. This course might be found to answer, if the whole imigration to this country consisted of farming people; but as it does not, and as a very large number of those annually arriving at our ports, consist of artizans in the various mechanical branches, from the principal manufacturing towns, and places of the old world, why should the suicidal course be persisted in, of encouraging or necessitating them to take to farming as the mode of earning their future living, or in the event of their not doing so, oblige them for the want of employment in their own line of business, to seek it in the neighbouring republic, where with their skill and industry they contribute to build up the manufactures of foreign competitors at the expense of our own, and at the same time essentially advance the farming interests of that country by increasing the home consumption of the products of the farm.

"Thousands of the most skilful artizans and workmen from the Old World, are year after year following their friends, and seeking homes on this side of the Atlantic; and for want of suitable employment for them under our national flag, they as regularly leave our shores for the United States, where, with the wealth of their skill and labour, they enrich that country and make happy homes for themselves.

"As a proof of what Canada has done with the little encouragement which the Legislature has afforded her manufactures, we have but to examine within the limits of this Exhibition ground, and we perceive an excellence displayed in almost every department of Arts and Manufactures, in many instances not excelled by the older countries of Europe and America.

"And to what eminence our manufactures might arrive if properly encouraged, seeing the extensiveness of our forests, and the richness and profusion of our mineral productions, not even the most sanguine can predict. Notwithstanding the discouraging circumstances under which some of our infant manufactures are labouring against foreign importations, yet many are still successfully working, not only against want of proper protection, but also against the absence of that patronage to which home manufactures have so just a claim."

It is almost needless to say that this Exhibition was most successful, and illustrated in a very complete and satisfactory manner the remarkable

progress made in the country in agriculture, manufactures and art.

The fourteenth Exhibition was held at Kingston, in the building already described. The prize list amounted to $10,513 ; the entries to 4,830, being more than one thousand short of the number of entries at Toronto the previous year. Nevertheless the display was regarded as satisfactory, particularly with respect to live stock and agricultural products. Besides the customary annual address of the President, lectures were delivered by Dr. Lawson, Professor of Chemistry and Natural History in the University of Queen's College, and by the Rev. Hannibal Mulkins, on Scientific Agriculture.

It has been remarked, in a preceding paragraph, that the Association began its existence in 1846, wholly without funds. In 1860 the auditors certified that they had examined the accounts, and found that the sum of one hundred and ten thousand nine hundred and eight dollars have been received by the indefatigable Treasurer, R. L. Denison, Esq., and that there remained a balance in his hands of eight thousand and twenty-eight dollars on the 20th Sept., 1859. What further illustration of the pecuniary prosperity of the Association is necessary ?

Ten years ago, the fourth Exhibition was held in the City of Kingston. Compare the fourth with the fourteenth Exhibition, and see the progress of the country reflected in the results.

Comparative Table showing the general results of the Exhibitions of 1849 *and* 1859.

	No. of Entries, 1849.	No. of Entries, 1859.
Blood Horses	16	9
Agricultural Horses	97	235
Heavy Draught Horses	...	34
Durham Cattle	54	68
Devon "	10	62
Hereford "	...	7
Ayrshire "	12	62
Galloway "	...	29
Grade "	51	38
Fat and Working Cattle	20	21
Leicester Sheep	79	90
Cotswold Sheep	...	29
Cheviot Sheep	...	12
Long-woolled Sheep	...	55
Southdown Sheep	16	53
Merino and Saxon Sheep	11	17
Fat Sheep	5	9
Yorkshire Pigs		11
Large Berkshire Pigs		2
Other large breed Pigs	59	9
Suffolk Pigs		23
Improved Berkshire Pigs		12
Other small breed Pigs		30
Poultry	22	179
Foreign Stock	39	22
Foreign Implements		2
Grain, Seeds, &c.		609
Roots and other Field Crops		368
Fruit	224	252
Garden Vegetables		349
Plants and Flowers		123
Dairy Products, Honey, &c.	63	156
Agricultural Implements—Power	101	141
Agricultural Implements—Hand		67
Cattle Food—Manures		9
Cabinet-ware	18	85
Carriages and Sleighs	40	54
Leather Manufactures		133
Fine Arts	78	165
Groceries and Provisions	...	185
Hats, Furs, &c.	...	46
Indian Work	3	104
Ladies' Work	165	318
Machinery, Metal Manufactures, &c.	29	183
Miscellaneous	...	84
Musical Instruments	...	11
Pottery, Building Stones, &c.	3	16
Paper, Printing, Book-binding, &c.	7	17
Woollen Flax and Cotton Goods	99	170
Foreign Manufactures	...	20

Hamilton had the honor of being the scene of the Fifteenth Exhibition of the Association, one memorable from the circumstance that it was visited by his Royal Highness the Prince of Wales. There is probably no site in the Province finer than that chosen for the Hamilton "Crystal Palace." The building is of wood and glass, upon a permanent foundation. The entire area of the building is about 36,000 feet, the ground plan being octagonal in form, having four transepts. The building is two stories in height; the first story 16 feet in the clear, and the second 15 feet to the line of the eaves, with an arched roof of light appearance. At the intersection of the cross is an octagonal space 76 feet in diameter, and 54 feet to the line of the roof, this portion is also arched in a most substantial manner; the roof is surmounted with a cupola. The extreme height from the ground floor to the top of the dome is 100 feet, which is surmounted by a flag-staff 25 feet in height. The length of the building is 171 feet by 71 in width, and contains about 24,000 feet on the ground floor. There are four galleries, 54 feet wide by about 64 feet long with a corridor running round the centre octagon, connecting all the galleries; these galleries contain about 12,000 square feet; four spacious stairways lead from the ground floor to the galleries. The diagonals which form the octagon are only carried up one story, with flat tin roofs—access to which can be obtained from the galleries—affording a fine place for a promenade and a beautiful view of the city and bay. One of the galleries is reserved especially for the exhibition of fine arts—three of its sides are close boarded, and the light admitted through the centre of the roof by a lantern-light extending the whole length, the glass is frosted, or obscured in order to diffuse a mellow light. The whole of the glass throughout the building is frosted.

All the windows have semi-circular heads, with cut trusses under the same. The whole of the wood-work, in the exterior as well as interior

is planed or wrought, together with the cornices; these cornices are supported at intervals with fine cut brackets. The building is painted outside with a warm light color, or stone tint, in oil; and it is intended to paint the interior in fresco. The dome, covered with tin, renders the building picturesque, and enables it to be seen a distance of several miles around. The gallery flooring is dressed and laid open, and the under side of the galleries lined with dressed boarding, to prevent the dust rising. The cost of the building was about $14,000.

In the address of the agriculturists, artisans, and manufacturers of Upper Canada to His Royal Highness, it was stated, that "This is the Fifteenth Exhibition of the Agricultural Association of Upper Canada, and we think it demonstrates to those who have witnessed the successive exhibitions from year to year, that they have been successful in stimulating the industrial classes in the improvement of all those productions upon which the property of Her Majesty's dominions so mainly depends." His Royal Highness in his reply said, "Blessed with a soil of very remarkable fertility, and a hardy race of industrious and enterprising men, this district must rapidly assume a most important position in the markets of the world."

Of this exhibition an able reporter states,* "The Exhibition of the Agricultural Association of Upper Canada, which has just been brought to a close, will long be regarded as a most brilliant epoch in the records of the Society. Closely connected with the visit of the illustrious personage, who made it the scene of his last public appearance in this part of the dominions of his Royal Mother, it possesses an historical interest which time will not readily efface, while as a memorial of the progress which we have made in those branches of industry most essential to our prosperity, it far outshines all that have preceded it."

We come now to the Sixteenth Annual Exhibition of the Association, that of the present year, when we enjoyed the opportunity of witnessing one of the most complete and successful displays which has yet taken place. In the ordinary course of events in Canada we naturally look for general progress in the staple industries of the country, notwithstanding years of depression and stagnation. One advantage of the periodical return to stated districts for the purposes of the Provincial Exhibition is the evident facility offered for making comparisons between the past and present, and estimating the amount of progress made in different departments near the scene where so much friendly rivalry and competition takes place. Is is not only reasonable to suppose, but it is a supposition well borne out by fact, that the merits of such exhibitions depend to a great extent upon the locality where they may be held. Proximity to the arena where competition takes place induces many to enter the lists who would be otherwise mere spectators of the rivalry of others. London is situated in the centre of one of the finest agricultural districts in the Province, and the expectation that all departments of husbandry would be fully represented, was more than realised.

The same object strikes different observers in many diverse ways. At the late London exhibition one fact could scarcely fail to arrest the attention of any visitor not wholly intent upon special subjects, but free to admire, or condemn, according to his unbiassed opinion.

While examining the workmanship we were not unmindful of the workman. It was a rare sight to witness so vast an assemblage and look in vain among them for a single object seeking compassion or indicating poverty and distress. Within the limits of the exhibition, such would necessarily be vain on account of the admission fee, but outside the gates where a large crowd remained during the days when the exhibition was open, not only was there an absence of any approach to mendicancy, but the appearance of the individuals composing the crowd indicated perfect freedom from privation or indigence. Not less surprising was the appearance of the visitors of all classes and grades, but especially of those who are the bone and sinew of the country. Thousands of strong and healthy looking men, the majority above the average height, spoke a language by their looks not to be misunderstood, and far better than words, described the country of their birth or adoption. Another marked feature of the present exhibition was its truly Canadian character, owing no doubt to the troubles in which the United States are involved, our friends across the border were not present in their usual strength, and though we may regret the cause, yet it shows us that we are now fully able to organize and carry out an unusually successful exhibition among ourselves, without even missing extraneous aid.

We do not propose to enter into a minute description of the London Exhibition, nor indeed is such the province of this *Journal*, but in a succeeding number we shall be able to describe and comment upon such articles in the department of Arts and Manufactures as may appear deserving of special notice. For the present it will be sufficient to give a general sketch, the particulars being so fully and truthfully furnished by the daily papers of London, Toronto and elsewhere, and already no doubt familiar to the readers of this *Journal*.

The building erected by the local committee was described in the last number, but for the sake of uniformity a brief notice is again given.

* Reported by Mr. William O'Brien, *Transactions of the Board of Agriculture*, Oct., 1860.

The exhibition building is erected in the vicinity of the Barracks, and within half a mile of the centre of the city, on a beautiful piece of ground of about twenty-six acres, a portion of which has been purchased from the Government by the Corporation for this purpose.

The ground plan of the building is a regular octagon, its dimensions from opposite angles being 186 feet. The space offered by the ground area is upwards of 24,000 feet, while the galleries give an additional space of 4,000 feet more. The external wall is built of white brick, on a foundation of rubble masonry and concrete, and is twenty-one feet in height. The entrance is through eight doorways, each eight feet wide and fourteen feet high, one at each angle. In the brick wall, on each side of the octagon and between the doorways, are five spacious windows, making on the ground floor forty windows. The roof of this portion of the structure is covered with felting, gravel, &c. The second tier of the building, containing the gallery, rises to the height of thirty-two feet above the ground line, and is 114 feet in diameter from opposite angles, giving a wall accommodation of more than 300 feet, lighted with forty-eight windows, every alternate one being hung on a pivot to admit of ventilation. The ascent and descent to the upper portion of the building is provided for by two stairways, one being intended for the entrance and the other for the exit of the public, and leading in opposite directions so as to divide the crowd. The third tier of the building is a continuation of the inside gallery wall, and runs to the height of forty feet above the ground line. This tier supports the cupola, and is covered with a shingle roof. The interior view is clear, and not interrupted by any timbers to the height of eighty-seven feet. The full height of the building, to the top of the flag-staff, is 114 feet; the dimensions of the cupola, twenty feet diameter by thirty-one in height; area of the ground floor and gallery 28,000 feet, being about the same area as the Hamilton Exhibition building, and 4,000 feet less than the Toronto building. The sheeting of the roof is painted a blue colour, the timbers a drab.

In expressing an opinion upon the manner in which the building served the purposes for which it was designed, we desire to avoid the appearance of criticising without suggesting beneficial alteration which would not be attended by much additional expense. First impressions are always most lasting, and when one enters a building crowded with objects of industry and art with a view to study or enjoy them, it is next to impossible to avoid being impressed more or less by the appearance of the structure in which they are displayed. The feeling produced on first entering the London Exhibition building is not a happy one. The gallery seems to drop like an opaque, dull and heavy screen before the spectator, at once creating disappointment and a disposition to be adversely critical. The massive supports in front of each doorway, obstructing the view across the building, increases the dissatisfaction, and the cold drab colouring of the plain undecorated timbers bring no relief to the eye, but rather confirms impressions just created. Red, white and blue are the natural colours for such a building, and there does not appear to be any valid reason why the gallery, which is painfully visible on entering, should not have been glazed and made instrumental in lighting the lower floor, and if not ornamental at least not an eyesore. Means, easily contrived, might with great advantage have been adopted for displaying a considerable part of the great variety of useful and ornamental ladies work above the gallery, where close inspection is not necessary, general effect being the object aimed at.

Passing now to the objects exhibited in the building, we are at once struck with the number of competing sewing machines ; it is not a little remarkable that this invention should have taken such wide spread root throughout the United States and Canada, and, although only a few years old, has already reached such excellence in results. Some of these machines are very ingeniously contrived, and leave little to be wished for as household labour-saving machines. The furniture was substantial and good, but not particularly distinguished for beauty of design, although the materials are excellent and the workmanship superior. A reference to the illustrated catalogue of the Great Exhibition at London would speedily develope a more elegant description of drawing room furniture. The skill to construct is very evident, but the taste to arrange is susceptible of improvement. It is very satisfactory to be able to note the taste for music, and the means of cultivating that delightful art, which appear to grow together in Canada. Piano-fortes of Canadian manufacture were very well represented, a fact which of itself speaks well for the progress of our civilization. The collection of pipes and tiles for draining is another suggestive feature, and shows how the true principles of agriculture are spreading throughout the country. The specimens of pottery and earthenware were good, but this art is as yet in its infancy in Canada, owing to the remarkable cheapness of the imported articles. There was nothing that may be called new in stoves, fire-grates, or apparatus for warming houses. In this climate one would naturally look for various designs for economising fuel and distributing a uniform temperature throughout our dwellings. The German tile stove, in its present elegant forms and excellent adaptations, does not appear to have attracted the attention of Canadian manufacturers. The manufactures in leather were

good and created a favourable impression, they included carriage and team harness, saddles, whips, belt leather, patent leather, leather, in a word, in all its forms and many of its adaptations. But we were disappointed with the small display of manufactures in wool, flax and cotton. We observed only cloth, winter and summer tweeds, blankets, carpets and counterpanes, woollen garments, flannel kerseys, woollen shawls, shirts, stocking, socks, and an assortment of cordage and twine. Many well known names were not among the exhibitors. Our flax and cotton manufactures had no representation; we know they exist now, but why were they not sent to our Provincial Exhibition.

The display of fruit considering the season, was magnificent. The flowers were indifferent, but the vegetables were good, and showed both improvement and skill. In horticulture immense strides have been made of late years in Canada.

The agricultural implements were very numerous and most of them of Canadian manufacture. Ploughs of many varieties, from the simple wooden implement adapted to the bush, to the drain plough for skilful and scientific husbandry. Subsoil, draining, and double mould ploughs are indicative of progress; where these implements are common, agriculture is in an advanced state. Mowing, reaping and other machines of this class were not so fully represented as might have been expected, but they are generally very ponderous and expensive to transport to great distances. Of cultivators the variety was also not in excess of former exhibitions. One important machine deserved particular notice as indicating progress. An improved liquid manure drill, for drilling two or more rows of liquid with turnips, mangels, carrots, &c., either on the ridge or flat. The use of liquid manures is of the utmost importance, and a machine to distribute them economically and uniformly is a great desideratum. The stump extractors were heavy cumbrous machines, wholly inapplicable for general use, especially when a stump extractor of far more simple character can be rigged by any farmer on his land with an ox chain and a long maple, elm or pine stick to act as a lever. The lever, which should be some fifty feet long, is fastened to the stump with a chain, and to the other extremity a pair of oxen or horses are attached, which rapidly twist the stump out of the ground. The minor implements used in husbandry were very numerous and of good construction, many of them having a finish highly creditable to the manufacturers. Bone manure in different sizes was present, but no superphosphates made from bones by the addition of sulphuric acid. This is one of the most valuable special manures, and should receive careful attention. Too much thought is apparently bestowed upon the multiplication of agricultural machines, to the neglect of those artifices whereby the fertility of the soil is maintained and increased. As we cannot always depend upon rotation of crops to fertilize our fields, we must look to manures, and after properly prepared farm-yard manure, bone dust and the phosphate from bones are the most valuable.

Two portable steam-engines were on the ground. This is another advance promising much for the future. In a report from the committee appointed by the Board of Arts and Manufactures, relative to the Great Exhibition held at London in 1862, particular attention was directed to the products of our forests. We are glad to see that a very excellent beginning has been made by Mr. Saunders of London, who displayed a very good collection of native medicinal plants, all of which were collected in the neighborhood of London. We would suggest that in future displays of the kind, the entire plant, if portable, should be exhibited, and when too large for such a purpose, a portion of the trunk, and specimens of the leaves. The Fine Art department was, on the whole, indifferent. Among a few paintings and drawings of superior merit were some wretched caricatures, for they were nothing better, displayed in painting in oil or water colours. Steps should be taken at future Exhibitions to make some selection before giving space to productions which might decorate the parlour of a remote country inn, but should not be admitted in a Provincial Exhibition as illustrations of provincial art. Of the Ladies' Work we have little to say; the most imposing contributions were the quilts, not differing in any marked particular from former specimens. A little attention to the selection of patterns, and the proper combination of colour, would be attended with advantage, and destroy, perhaps, the uniformity which appears to prevail in those particulars.

The Natural History department received considerable attention, and was represented by Canadian stuffed birds, native fishes, native insects, mammalia, native plants, and specimens of the woods of Canada in section and with the bark; also that delightful source of amusement and instruction, an aquarium, was exhibited.

It does not come within the province of this journal to describe the farming stock; but it would be unfair not to express both gratification and surprise at the display. In every department there was a marked improvement, and all evidently in the right direction. There cannot be a doubt in the mind of any one present at the Exhibition that astonishing progress has been made in Canada in this department of husbandry.

The Address was delivered by the President of the Association, John Barwick, Esq., of Woodstock, who took an enlightened view of the importance of

giving every encouragement to home manufactures. Mr. Barwick said in his Address :—

"Our aim should be to foster Canadian manufactures of those articles that we can advantageously produce. Every Canadian will concede that it is of great importance that our towns should be occupied by thriving mechanics and manufacturers, thereby giving to us a home market. How many of the youthful population of our towns and villages might be advantageously and economically employed in woollen and cotton factories who are now in too many instances, a burthen on their parents, and at the same time it is to be feared are in a course of training to become vicious members of society. The crop of wool for this year has been principally purchased for exportation to Great Britain, heretofore it has been exported to the United States to be there manufactured. Flax and hemp are certain and very productive crops in Canada, and might be advantageously grown for manufacturing purposes."

Mr. Barwick also said that "a very excellent suggestion was made in the September number of '*The Journal of the Board of Arts and Manufactures for Upper Canada*,'—'That a museum of natural products, both mineral, vegetable, and even animal, might rapidly be formed at each permanent Exhibition Building.'"

The amount of prizes given by the Association this year exceeded $12,000 ; the number of entries was above 6,000. On Thursday, the day on which the public were admitted at a reduced charge, the number of persons who passed through the exhibition building exceeded fifty thousand. We are, probably, within the mark, when we hazard the opinion, that there were between fifty and fifty-five thousand visitors present. It would be premature to institute any comparisons, based upon statistics, between this and preceding Exhibitions. It is sufficient to say, for the present, that it far exceeded general anticipations ; that it was well arranged, well sustained, and was a flattering and cheerful exposition of the progress of the country in wealth, industry, and civilization.

Comparative Statement showing the amount of competition at all the Exhibitions held by the Association, between 1846 *and* 1858, *inclusive* :

EXHIBITIONS.	Amount of Prizes Offered.			Tot. No. Entries.	Amount of Pri's Awarded		
	£	s.	d.		£	s.	d.
Toronto, 1846	400	0	0	1,150	275	0	0
Hamilton, 1847	750	0	0	1,600	600	0	0
Cobourg, 1848	775	0	0	1,500	575	0	0
Kingston, 1849	1,400	0	0	1,429	700	0	0
Niagara, 1850	1,276	11	9	1,638	950	0	0
Brockville, 1851	1,254	9	3	1,466	805	18	9
Toronto, 1852	1,479	9	9	3,048	1,228	5	0
Hamilton, 1853	1,602	10	9	2.820	1.323	6	3
London, 1854	1,794	0	6	2,933	1,356	17	6
Cobourg, 1855	2.304	1	6	3,077	1,735	8	6
Kingston, 1856	2,309	12	6	3,791	1,699	17	6
Brantford, 1857	2,517	17	0	4,337	2,046	10	0
Toronto, 1858	2,675	2	6	5,572	2,303	15	0

The Board of Arts & Manufactures
FOR UPPER CANADA.

THE GREAT EXHIBITION OF 1862.

The following letter has been received by Dr. Beatty, the President of the Board of Arts and Manufactures for Upper Canada. The appointment of an honorary Commission without funds to meet the necessary expenses attendant upon its meetings, &c., is of doubtful value.

SECRETARY'S OFFICE,
QUEBEC, 26th September, 1851.

SIR,—I have the honor to inform you that His Excellency the Governor General has had before him in Council petitions from the Boards of Arts and Manufactures of Upper and Lower Canada, and also from the Board of Agriculture of Lower Canada, on the subject of the proper representation of the products of Canada at the great International Exhibition to be held in London in 1862.

It had also been announced to His Excellency that Her Majesty's Commissioners for such International Exhibition will only communicate with Canadian Exhibitors through a Commission appointed by his Excellency for that purpose.

Under these circumstances His Excellency in Council has demed it expedient to appoint a Commission for the purpose above stated.

His Excellency has further been pleased to name the following gentlemen to act on such Commission, namely: —Sir William Logan, The Hon. Louis V. Sicotte, President of the Board of Agriculture, Lower Canada; Edward W. Thomson, Esq., President of the Board of Agriculture, Upper Canada; John Beaty, jun., Esq., M.D., President of the Board of Arts and Manufactures, Upper Canada; Iram C. Taché, Esq., M.D., and Brown Chamberlain, Esq., Secretary of the Board of Arts and Manufactures, Lower Canada.

His Excellency desires me to express his hope that you may find it consistent with your other engagements to act as one of the said Commissioners.

The appointment, I should add, is merely honorary.

I have the honor to be, Sir,
Your most obedient servant,
C. ALLEYN, Secretary.

John Beaty, jun., Esq., M.D.,
President Board of Arts and Manufactures, U. C.,
Toronto.

THE AGRICULTURAL STATUTE.

At the Annual Meeting of the Provincial Association held at London on the 27th ult., the following resolution was proposed by Col. Thompson :—

COL. THOMPSON moved—"That notice be given to the several electoral division Societies, to send each one delegate to attend a meeting to be holden in Toronto, the month preceding the meeting of the Legislature, for the purpose of agreeing upon and recommending such alterations as they might deem necessary in the Agricultural Statute."

The motion was seconded by the Hon. Mr. ALEXANDER, M.L.C.

Upon the suggestion of Dr. Beatty, of Cobourg, the words "and that the Boards of Arts and Manufactures, and Horticultural Societies be invited to attend," were added.

Mr. Fergusson moved—"That in order more fully to carry out the spirit of the foregoing resolution a synopsis of the bill introduced at the last meeting be published, and a copy be sent to each county and electorial division Society, and that the travelling expenses of the delegates be paid out of the funds of the Association."

Both resolutions were carried.

BOOKS ADDED TO THE FREE LIBRARY OF REFERENCE DURING THE PAST MONTH.

CLASS III.

Gothic Architecture, an introduction to the study of; 12mo; 1861.......... *J. H. Parker.*
Model Architect: A series of Original Designs for Cottages, Villas, Suburban Residences, etc.; accompanied by explanations, specifications, estimates, and elaborate details; 2 Vols., folio; 1860.......... *Samuel Sloan.*
Villas and Cottages: A series of Designs prepared for execution in the United States; 8vo; 1857.......... *Calvert Vaux.*

CLASS VI.

What Illuminating Was: A Manual of the History of the Art; 12mo; 1861.......... *Wyatt & Tymms.*
What Illuminating should be, and how it may be practised: A Technical Manual; 12mo; 1861.......... *Wyatt & Tymms.*

CLASS VIII.

Progressive Drawing Book of the Human Figure; folio.......... *Julien.*
" " " Human Heads; folio.......... *Julien.*

CLASS IX.

Millwright and Miller's Guide, illustrated by 28 descriptive plates, with additions by T. P. Jones; 8vo; 1853.......... *Oliver Evans.*
Railroad Construction, a Handbook of, for the use of American Engineers; 8vo; 1857.......... *George S. Vose.*
Railway Machinery: A Treatise on the Mechanical Engineering of Railways, embracing the principles and construction of Rolling and Fixed Plant; illustrated by a series of plates on a large scale, and by numerous engravings on wood; 2 Vols., folio; 1855.... *D. R. Clark.*

CLASS XV.

Laws of Shipping and Insurance with an Appendix containing the Merchant Shipping Act, &c.; 12mo; 1859.......... *James Lees.*

CLASS XVII.

Marine and Naval Architecture; A Treatise on; or Theory and Practice blended in Ship Building; illustrated with more than fifty engravings; folio.......... *J. W. Griffiths.*

CLASS XVIII.

Report of Commissioner of Patents for the United States, on Agriculture; 2 Vols., 1855–6.
Report of Commissioner of Patents for the United States, on Arts and Manufactures; 2 Vols.; 1859..........

CLASS XXI.

Illustrated Horse Doctor; being an accurate and detailed account of the various Diseases to which the Equine Race are subjected; together with the latest mode of treatment, and all the requisite prescriptions, written in plain English; 8vo; 1861.......... *Ed. Mayhew.*

The Board of Arts & Manufactures FOR LOWER CANADA.

ANNUAL COURSE OF FREE LECTURES.

"THE HISTORY AND LAW OF LETTERS PATENT OF INVENTIONS,"

BY DUNBAR BROWNE, M.A., B.C.L.

Society may be sub-divided into numerous sects upon religious, political or philosophical questions, but all men agree to use the improvements that are introduced in our physical life, and endeavour to increase them, inasmuch as each, no matter what opinions he may profess to entertain, loves the welfare of himself and his family and prefers ease and luxury to toil and drudgery. Look at the changes which have taken place within a few years. Are not our dwellings better constructed! better lighted! better ventilated! better heated! and better adapted to resist the attacks of the elements! Are not our vestments better, more comfortable, more durable, and less expensive? Are not our tables better supplied with nourishing and pleasant food? Are not our means of transport multiplied, and our journeys and distances shortened? Is not the very earth made subservient to our wants, and does she not yield her increase under the exercise of man's skill! And yet these are but the conquests of intelligence

over material things—changes which have been wrought by two potent agencies wielded by human intellect—Science and Invention.

Inventions are the offspring of reason, and as man's thoughts are his own, so an invention before being put into use exists only in the mind of its author; but so soon as his secret is disclosed to the public, the latter have a right to make use of it in any manner they please, without incurring any liability to the inventor.

As society is composed of many members, and makes rules and regulations for the protection and guidance of each, so the author of an invention is encouraged to carry on and disclose to the public the manner of constructing such invention on terms of mutual benefit, which it will be my object to explain.

The inducement given to inventors to complete their inventions consists of a species of monopoly, whereby the author of an invention is enabled to reap a reward according to the importance of his product, and when it sometimes happens that inventions are useless, the monopoly granted to the inventor for such invention is valueless, the value of the monopoly being proportionate to the value of the invention.

This monopoly or exclusive right to use an invention is a matter of favor rather than of right, and is a privilege granted by the Crown to the subject.

Although the origin cannot be traced, yet there is little doubt that England first adopted this system of rewarding inventors, and there is reason to believe that this prerogative of the Crown is a very ancient one. Hindmarch, in his treatise on Patent Law, alluding to this, says:—" Thus in a case decided " in the reign of Edward III., it is said that arts " and sciences which are for the public good are " greatly favored in law, and the King, as chief " guardian of the common weal, has power and " authority by his prerogative to grant many privi- " leges for the sake of the public good, although " *prima facie* they appear to be clearly against " common right."

The same author also mentions that during the reign of the same monarch, Edward III., " some " alchymists persuaded the King that a philoso- " pher's stone might be made, and that the King " granted a commission to two friars and two " aldermen to enquire if it was feasible, who cer- " tified that it was, and that the King granted to " the two aldermen a patent of privilege."

Monopolies, therefore, were granted in the early periods of the mother country, consisting of privileges procured by purchase or by favor from the reigning sovereign. These were, to a certain extent, equivalent to our Letters Patent, conferring upon the recipient exclusive privileges, differing, however, from those granted at the present time, in that they included not only manufactures, but even branches of trade.

The power to grant patents and the privileges to which this power gives rise are regulated by the common law, by statute law, and by the decisions of the courts. At first these grants had but little reference to the encouragement of inventive powers, but consisted more of trading privileges granted to a number or numbers of towns confederated together, the first of which was the Hanseatic League, to which England was to a certain degree indebted for her commercial importance, London being the only English town admitted into that great confederacy.

King John was the first to grant privileges and franchises to the metropolis and other English towns, and as far back as that period can be traced the existence of several London companies. Little change occurred in the commercial system of England from the death of King John, which occurred in the year 1216, to the reign of Queen Elizabeth, who succeeded to the throne of England in 1558. Though shackled with monopolies, with which the ignorance and bad faith of successive governments had oppressed it, commerce slowly but continuously gained ground. Monopoly was the great grievance of Elizabeth's reign. When an individual by talent, industry and research, makes a useful discovery, there is every reason for granting him an exclusive right of using it for a limited time as a reward for his ingenuity. This principle was early understood, but Elizabeth perverted it into the granting of patents for ordinary manufactures, or for the importation of foreign articles, either as gifts to her courtiers or as a means for raising money without the necessity of appealing to Parliament. Against this injustice the people cried out so loudly that Elizabeth had the grace or the good policy to admit she had been misled, protesting solemnly, however, that she had never granted one patent which she did not believe to be conducive to the public good. Some of the patents were then remitted to the courts of law, and were by them condemned as illegal. It should, however, be allowed that all the commercial monopolies granted in this reign were not detrimental to the English nation, for by her was the first charter granted to the East India Company, a monopoly which has served in no small degree to raise England in the scale of nations.

During the reign of Elizabeth's successor, James, Sixth of Scotland and First of England, monopolies were carried to such an extent, that instead of being productive of benefit, they, on the contrary, only gave rise to great dissatisfaction, until at length the people called so loudly for redress that the Legislature deemed it expedient to listen to the remon-

strances of the community and directed their attention to the subject, whereupon a committee was appointed to investigate the matter and alleviate the grievances complained of. The committee appointed to examine into these abuses began with three of them, one of which was for licensing all houses, a second for the inspection of inns and hostelries, and the third for the manufacture of gold and silver thread.

The result of this investigation brought to light a scene of fraud and corruption seldom to be met with, even under the most cruel and tyrannical governments. These three monopolies were set aside as being national grievances, and the patentees, Sir Giles Monyresson and Sir Francis Mitchell, were denounced as criminals, and from that time this matter became the subject of legislative enactments, and the "statute of monopolies" was passed, whereby the Crown gave up its right, or rather the right it claimed to grant monopolies, and in lieu thereof ascertained and fixed a limit to be observed in the consideration of all such matters, reserving to itself certain powers, and which exist and are exerted in the present time, extended as they have been by certain statutes passed in the reigns of the late and the present Sovereigns, to meet the exigencies of particular cases, and to render impartial justice between man and man.

The act referred to declared that all monopolies, grants and Letters Patent for the sole buying, selling, making, working or using of anything within the realm were contrary to law and void; but it made an exception of new inventions, still allowing the common right to take effect if the grants even for new inventions were not properly made. By this statute the Crown was deprived of its right to grant patents detrimental to the interests of trade.

Though suited to the age in which it was passed, this enactment was found, however, to restrict too much the enjoyment of patent privileges, and in consequence its signification has been modified by the decisions of the English courts of law and equity.

Nearly one whole century elapsed without any further change, and it was only in the reign of Queen Anne that the next alteration was made in the Patent law, by which the inventor was obliged to fyle within a limited time a written description of his invention, setting it forth in a fully comprehensive manner, otherwise the Letters Patent should become void. This instrument is the specification.

No further legislative enactments were made on this subject until within our own time, when in 1835 a bill, known as Lord Brougham's Act, was successfully carried through Parliament, where it was permitted to the patentee to fyle a disclaimer or renunciation of what was claimed by him as his invention, if such extra claim was made through error, as well as amendments, where doubts existed, and thereby the patentee was protected against the effect of errors which had been overlooked at the time the patent was applied for, errors which might otherwise vitiate the patent. This statute also allowed an extension of patents beyond the original term of 14 years, with consent of the Privy Council.

The most important changes in the Patent Laws of England were only effected, however, by an act passed on the first of July, 1852, containing provisions of a most liberal and beneficial nature, whereby one patent is granted for the United Kingdom of Great Britain and Ireland instead of three as heretofore. The average cost of each of these patents was £100, sterling, making £300 for a patent for the whole kingdom. The system of caveats was done away with as being fraught with injustice, and a system of protection provided for, which affords the inventor time to fully complete his invention without fear of piracy, and to ascertain the value of his invention after having worked out his ideas, before incurring the expense of a patent. A caveat is an instrument by which notice is requested to be given to any person having conceived, but not thoroughly completed an invention, whenever another person shall apply for a patent for such an invention. By this act British patents were restricted to the United Kingdom and to such colonies as had not enacted laws on this subject for themselves. It not only simplified proceedings, but introduced a more moderate scale of fees and a more convenient and equitable distribution of the periods for the payment of them. The patent office is placed under the control of commissioners, and is located in London, there being but one patent office for the United Kingdom. In connection with this office there is a free library which is daily open to the public for reference, and in a portion of the museum at South Kensington which was assigned to the commissioners by the Board of Trade, are daily exhibited, gratuitously to the public, a collection of very valuable and interesting models of patented machines and implements as also portraits of inventors. There are also in Edinburgh and Dublin places of deposit of copies of patents, specifications, disclaimers and other documents connected with patents for public inspection.

The Patent Laws of England, as they now exist, adapted to the decisions of the Courts of Law and Equity, are in my opinion the best in force in any country, for they not only acknowledge the rights of the inventor, no matter to what potentate he pays his allegiance, but they offer encouragement to perseverance and application, and invite the inventor to renewed exertion, fully partaking of that spirit of justice and liberality which has rendered the

reign of our present Gracious Sovereign a blessing not only to her own subjects, but to the age in which we live.

Having thus cursorily reviewed the history of the Patent Laws of the mother country, let us turn to our own Canada and see what has been done here for the protection and encouragement of the inventor, and how the Government of Canada recognizes the validity of the inventor's claims.

The introduction into the Province of grants of this description is of recent date, the first statute having been signed on the 9th March, 1824. It consisted of ten short sections, whereby any British subject residing in Canada could obtain a patent (extending over 14 years) for the invention of any art, machine, manufacture or composition of matter not known or used before in this Province by presenting to the Governor General a petition setting forth these facts, and fyling therewith a specification, drawings and a model in the office of the Provincial Secretary. The fee for a patent was £3 10s. or $14. The first Canadian patent was granted under the provisions of this act on the 8th of June of the same year 1824, three months after this act came into force.

The Government of Canada having published lately the specifications of patents issued in both Provinces, before and after the Union, from the year 1824 to January, 1844, and the specifications and drawings from the latter period to May, 1849, I am enabled to call your attention to some of the patents granted during those periods, that you may see how little attention the applications must have received before being granted. During 1824 but three patents were granted. (*See Patents.*) In 1825 there was but one grant. In 1826 there were three. In 1827 and '28 no grants were made. So that from 1824 to 1828, a period of five years, but seven Canadian patents were granted.

On the first of May, 1828, this statute expired by limitation, and no further action was taken until the following year, when an act was passed reviving and continuing the provisions of the first act until the first of May, 1831, with an additional clause extending its provisions to British subjects, residents of this Province, who, while travelling in foreign countries, discovered any invention not in use in Canada, and allowing them to take out a patent for its introduction, and placing them on the same footing and subject to the same conditions as inventors.

From the 31st October, 1826, to the 3rd October, 1829, not a single patent was issued in Canada.

In March, 1831, an act was passed extending the last act until 1836, and limiting patents of introduction to inventions discovered by Canadians while travelling in countries other than the United States and the British dominions.

In 1836 all acts passed on this subject were repealed and another passed, whereby it was provided that application for Letters Patent should be made by petition to the Governor General; that a specification and drawings and a model should be deposited with the Provincial Secretary, who should make out the patent and submit it to the Attorney General, who should, within fifteen days, certify at its foot the correctness or incorrectness of the grant and return it to the Provincial Secretary, who, if correct, should submit it to the Governor General for signature, and then record it in a book to be kept for that purpose, after which it was to be given to the patentee.

It was further provided that the discoverer of any improvement in the principle of any machine, &c., could patent the improved article, but the two patents were held to be distinct, and neither the original patentee was permitted to use the improvement nor the patentee of the improvement to use the original invention.

With the exception of the fee, which was reduced to $10, the other sections were those of the previous act.

In the spring of 1840, the Special Council, sitting at Montreal, passed an ordinance declaring the provisions of this act to be permanent. In 1849 an act repealing the Patent Laws in force was passed, and another enacted, which was again amended in 1851. From the 9th of March, 1824, to the 11th of May, 1849, inclusive, a period of over 25 years, there were granted in Canada 290 patents, being at the rate of eleven per annum.

The two acts of 1849 and 1851 now merged into the 132nd chapter of the Consolidated Statutes of Canada, form the Patent Laws of this Province, as they exist at the present day, and are common to both sections.

(*To be continued.*)

NOTES ON THE HISTORY OF PETROLEUM OR ROCK OIL.

By T. STERRY HUNT, M.A., F.R.S., of the Geological Survey of Canada.

Abridged from the *Canadian Naturalist*, July, 1861.

Public attention has lately been drawn to the petroleum furnished by the oil wells in Canada and the United States, and we have therefore thought it well to bring some few facts which may serve to explain the origin of this and of similar substances, including naphtha, petroleum or rock oil, and asphalt or mineral pitch, all of which are forms of bitumen, the one being solid and the others fluid at ordinary temperatures. These differences are, in many cases at least, due to subsequent alterations; the more liquid of these substances are mixtures of oils differ-

ing in volatility, and by exposure to the air become less fluid, and partly by evaporation, partly by oxydation from the air, eventually become solid and are changed into mineral pitch. These substances, which are doubtless of organic origin, occur in rocks of all ages, from the Lower Silurian to the tertiary period inclusive, and are generally found impregnating limestones, and more rarely, sandstones and shales. Their presence in the lower palæozoic rocks, which contain no traces of land plants, shows that they have not been in all cases derived from terestial vegetation, but they have been formed from marine plants or animal: the lattter is not surprising when we consider that a considerable portion of the tissues of the lower marine animals is destitute of nitrogen, and very similar in chemical composition to the woody fibre of plants. Besides the rocks which contain true bitumen we have what are called bituminous shales, which when heated burn with flame, and by distillation at a high temperature yield, besides imflamable gases, a portion of oil not unlike in its characters to petroleum. These are in fact argillaceous rocks intermixed with a portion of organic matter allied to peat or lignite, which by heat is decomposed and gives rise to oily hydrocarbons. These inflamable or lignitic shales, which may be conveniently distinguished by the name of *pyroschists* (the *brandschiefer* of the Germans) are to be carefully distinguished from rocks containing ready-formed bitumen; this being easily soluble in benzole or sulphure of carbon can be readily dissolved from the rocks in which it occurs, while the pyroschists in question yield, like coal and lignite, little or nothing to these liquids.

It is the more necessary to insist upon the distinction between lignitic and bituminous rocks, inasmuch as some have been disposed to regard the former as the source of the bitumen found in nature, which they conceive to have originated from a slow distillation of these matters. The result of a careful examination of the question has however led us to the conclusion that the formation of the one excludes more or less completely that of the other, and that bitumen has been generated under conditions different from those which have transformed organic matters into coal and lignite, and probably in deep water deposits, from which atmospheric oxygen was excluded. Thus in the palæozoic strata of North America we find in the Utica and Hamilton formations, highly imflamable pyroschists which contain no soluble bitumen, and the same is true to a certain extent of some limestones, while the Trenton and Corniferous limestones of the same series are impregnated with petroleum or mineral pitch, and as we shall show, give rise to petroleum springs. The fact that intermediate porous strata of similar mineral characters are destitute of bitumen, shows that this material cannot have been derived from overlying or underlying beds, but has been generated by the transformation of organic matters in the strata in which it is met with. This conclusion is in accordance with that arrived at by Mr. S. P. Wall in his recent investigations in Trinidad.

The sources of petroleum and mineral pitch in Europe and in Asia, are for the most part, like those just named, confined to rocks of newer secondary and tertiary age, though they are not wanting in the palæozoic strata, which in Canada and the United States furnish such abundant supplies of petroleum. In the great palæozoic basin of North America bitumen, either in a liquid or solid state, is found in the strata at several different horizons. The forms in which it now occurs depend in great measure upon the presence or absence of atmospheric oxygen since by oxydation and volatilization the naptha or petroleum, as we have already explained, becomes slowly changed into asphalt or mineral pitch, which is solid at ordinary temperature. It would even appear that by a continuance of the same action the bitumen may lose its fusibility and solubility, and become converted into a coal-like matter.

An evidence of the presence of unaltered petroleum in almost all the Lower Silurian limestones is furnished by the bituminous odor which they generally exhibit when heated, struck or dissolved in acids. In some cases petroleum is found filling cavities in these limestones, as at Riviere à la Rose (Montmorenci,) where it flows in drops from a fossil coral of the Birdseye limestone, and at Pakenham, where it fills the cavities of large orthoceratites in the Trenton; from some specimens nearly a pint of petroleum has been obtained; it is also said to occur in the township of Lancaster in the same formation. The presence of petroleum in the Lower Silurian rocks of New York is shown in the township of Guilderland near Albany, where according to Beck, considerable quantities of petroleum are collected upon the surface of a spring which rises through the Hudson River or Loraine shales. On the Great Manitoulin Island also according to Mr. Murray, a petroleum spring issues from the Utica state, and he has described another at Albion Mills near Hamilton rising through the red shales of the Medina group; these have probably their origin in the Lower Silurian limestones, which may in some localities prove to be valuable sources of petroleum.

In the Upper Silurian and Devonian rocks bitumen is much more abundant; Eaton long since described petroleum as exuding from the Niagara limestone, and this formation throughout Monroe county in western New York is described by Mr. Hall as a granular crystalline dolomite including small laminæ of bitumen, which give it a resinous lustre. When the stone is burned for lime the bitumen is sometimes so abundant as to flow like tar from the kiln. In the Corniferous limestone, at Black Rock on the Niagara River, petroleum is described as occurring in cavities, generally in the cells of fossil corals, from which, when broken, it flows in considerable quantities. It also occurs in similar conditions in the Cliff limestone (Devonian) of Ohio.

Higher still in the series, at the base of the Hamilton group, occur what in New York have been called the Marcellus shales; these enclose septaria or concretionary nodules which contain petroleum, while at the summit of the same group similar concretions holding petroleum are again met with. The sandstones of the Portage and Chemung group in New York are in many places highly bituminous to the smell, and often contain cavities filled with petroleum and in some places seams of indurated bitumen. A calcareous sandstone from this formation at Laona near Fredonia in Chatauque county containing more than two per cent of bituminous matter. At Rockville in Alleghany county, according to Mr. Hall, the same sandstones are highly bituminous and give out a strong odour when handled, and in the counties of Erie, Seneca and Cataraugus abundant oil springs rise from the sandstones and have been known to the Seneca Indians from ancient times.

In the northern part of Ohio, according to Dr. Newberry, petroleum is found to exude in greater or less quantity from these sandstones wherever they are exposed, and the oil wells of Pennsylvania and Ohio are sunk in these Devonian sandstones, often through the overlying carboniferous conglomerate, and in some cases apparently, according to Newberry, through the sandstones themselves, which are supposed by him to be only reservoirs in which the oil accumulates as it rises through fissures from a deeper source, in proof of which he mentions that in boring wells near to each other, the most abundant flow of oil is met with at variable depths. In some instances the petroleum appears to filter slowly into the wells from the porous strata around, which are saturated with it, while at other times the bore seems to strike upon a fissure communicating with a reservoir which furnishes at once great volumes of oil. An interesting fact is mentioned in this connection by Mr. Hall. In the town of Freedom, Catarragus Co., New York, is a spring which had long been known to furnish considerable quantities of petroleum. On making an excavation about six yards distant, to the depth of fourteen feet, a copious spring of petroleum arose, and for some time afforded large quantities of oil, after which the supply diminished in both the oil and new springs, so that it is now less than at the first settlement of the country. Notwithstanding its general distribution throughout a considerable region in the adjacent portions of New York, Pennsylvania and Ohio, it is only in a few districts that it has been found in quantities sufficient to be wrought with profit. The wells of Mecca in Trumbull Co., Ohio, have been sunk from 30 to 200 feet in a sandstone which is saturated with oil; of 200 wells which have been bored, according to Dr. Newberry, a dozen or more are successfully wrought, and yield from five to twenty barrels a day. The wells of Titusville on Oil Creek, Pennsylvania, vary in depth from 70 to 300 feet, and the petroleum is met with throughout. The oil from different localities varies considerably in color and thickness, and in its specific gravity, which ranges from 28° to 40° Baumé, (from ·890 to ·830)

The valley of the little Kenawha in Virginia, which is to be looked upon as an extension of the same oil-bearing region, contains petroleum springs, which so long ago as 1836, according to Dr. Hildreth, yielded from fifty to a hundred barrels yearly. It here rises through the carboniferous strata, and as elsewhere is accompanied by great quantities of inflamable gas.

The black inflamable shales of the Devonian series in western Canada which were formerly referred to the Hamilton group, and are now considered to belong to the base of the overlying Portage and Chemung, appear at Kettle Point on Lake Huron and in portions of the region southward to Lake Erie, but the oil wells sunk in Enniskillen show that the source of the oil is really below the horizon of these shales, inasmuch as the underlying argillaceous shales and limestones of the Hamilton group are there found near the surface, and have been penetrated 120 feet, at which depth oil is still met with, leaving but little doubt that it is derived from the limestones beneath, which both in New York, and in Canada are impregnated with petroleum. A somewhat slaty brownish-black bituminous dolomite belonging to the Corniferous limestone from Kincardine, gave me not less than 12.8 per cent. of bitumen, fusible and readily soluble in benzole, and another from the Grand Manitoulin Island, which was a brown crystalline dolomite, yielded from 7.4 to 8.8 per cent. of similiar bitumen. The solid form of this bitumen at the outcrop of the rocks, is probably due to the action of the air.

The existence of liquid bitumen in the Corniferous limestone in western Canada was pointed out as long ago as 1844 by Mr. Murray, who tells us that this rock is generally bituminous, and that cavities in it are often filled with petroleum; the quarries near Gravelly Bay in Wainfleet are cited as an example, (Report of Geol. Survey, 1846, p. 87). In the Report for 1850 we find a notice of what are called oil springs, in which petroleum rises to the surface of the water near the right bank of the Thames in Mosa, and in two places on Bear Creek in Enniskillen. Subsequently Mr. Murray described a considerable deposit of solid bitumen or mineral tar, which occurs in the same township, extending over about half an acre, and in some places two feet in thickness, doubtless formed by the drying-up of petroleum springs, Report for 1851, p. 90.) I had already in the Report for 1849, p. 99, described this bitumen from specimens in the Museum of the Geological Survey, and called attention to its economic applications, remarking that "the consumption of this material in England and on the continent for the construction of pavements, for paving the bottoms of ships, and for the manufacture of illuminating gas is such that the existence of these deposits in the country is a matter of considerable importance." At this time solid bitumen was thus employed, but in the liquid form of petroleum its use was chiefly confined in Europe to medicinal purposes. Under the names of Seneca oil and Barbadoes tar it had long been known and employed medicinally by the native tribes of America. Its use for burning, as a source of light or heat, in modern time has been chiefly confined to Persia and other parts of Asia, although in former ages the wells of the Island of Zante described by Herodotus, furnished large quantities of it to the Grecian Archipelago, and Pliny and Dioscorides describe the petroleum of Agrigentum in Sicily, which was used in lamps under the name of Sicilian oil. The value of the naptha annually obtained from the springs at Bakoum in Persia on the Caspian sea was some years since estimated by Abich at about 600, 000 dollars, and the petroleum wells of Rangoon in Burmah are said to furnish not less than 400,000 hogsheads yearly. In the last century the petroleum or naphtha obtained from springs in the Duchy of Parma was employed for lighting the streets of Genoa and Amiano. But the thickness, coarseness and unpleasant odor of the petroleum from most sources were such that it had long fallen into disuse in Europe, when in 1847, the attention of Mr. Young, a manufacturing chemist of Glasgow, was called to the petroleum which had just been obtained in considerable quantities from a coal mine at Riddings in Derbyshire, from which by certain refining processes he succeeded in preparing a good lubricating oil. This source however soon becoming exhausted, he turned his attention to the somewhat similar oils which Reichenbach and Selligue had long before showed might be economically obtained by the distillation of coal, lignite, peat and pyroschists. To this new industry Mr. Young gave a great impetus, and in connection with it attention was again turned to the refining of liquid and solid bitumens, it being

found that the latter by distillation gave great quantities of oils identical with those from petroleum.

* * * * *

The (Canadian) wells occur along the line of a low broad anticlinal axis which runs nearly east and west through the western peninsula of Canada, and brings to the surface in Enniskillen the shales and limestones of the Hamilton group, which are there covered with a few feet of clay. The oil doubtless rises from the Corniferous limestone, which as we have seen contains petroleum; this being lighter than the water which permeates at the same time the porous strata, rises to the higher portion of the formation, which is the crest of the anticlinal axis, where the petroleum of a considerable area accumulates and slowly finds its way to the surface through vertical fissures in the overlying Hamilton shales, giving rise to the oil springs of the region. The oil is met with at various depths; in some cases an abundant supply is obtained at forty feet, while near by it is only met with at three or four times that depth, and in sometimes only in small quantities. Everything points to the existence of separate fissures communicating with a deep-seated source. At Kelly's well however, it would appear that a reservoir has been formed much nearer the surface, where in a bed of gravel and boulders, underlying the superficial clays, the oil rising from the rocks beneath has accumulated. The inflamable gas which issues from the wells is not necessarily connected with the petroleum, inasmuch as it is an almost constant product of the decomposition of organic matters, and is copiously evolved from rocks which are destitute of bitumen. It is similar to the gas of marshes and to the fire damp of coal mines. The question of the extent of the supply of petroleum is not easily answered; the oil now being wrought is the accumulated drainings of ages, concentrated along certain lines of elevation, and the experience of other regions has shown that the sources are sooner or later exhausted; but though the springs of Agrigentum, like those of Derbyshire, have nearly ceased to flow, those of Burmah and Persia still furnish, as they have for ages past, immense quantities of oil; nothing but experience can tell us the richness of the subterranean reservoirs. It is not probable that the Devonian limestone is equally rich in petroleum throughout its whole distribution, but the exposures of it in the west are too few to enable us as yet to say in what portions the petroleum predominates; as however this rock underlies more than one-half of the western peninsula, we may look for petroleum springs much farther east than Enniskillen. A well yielding considerable quantities of petroleum is said to occur in the township of Dereham, about a quarter of a mile S. W. of Tilsonburg, we may reasonably expect to find others along the line of the anticlinal, or of the folds which are subordinate to it.*

* [See the June Number of the Journal of the Board of Arts and Manufactures for a description of the Oil Districts in Enniskillen. —EDITOR, Jour. of Arts and Man.]

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Selected Articles.

THE ORIGIN OF COAL.

By Robert Hunt, Esq., F.R.S.

Before we can enter on the question of the origin of coal, it is necessary to state how we determine it to be of vegetable origin.

It has been said, by some microscopic observers, that a true ligneous structure can be detected in coal; this is, however, denied by our most eminent botanists. Plants, in great abundance, are found preserved in the coal measures; but these are not in the state of coal. However, the chemical constitution of coal clearly indicates it to have originated from plants. The vegetable world consists, essentially, of carbon, combined with the two gaseous bodies which form water—hydrogen and oxygen; and coal is formed of the same elements, differing only in the proportions in which they are combined. The progress of the change, from a living tree growing in the sunshine, to a dead lump of coal lying deep in the earth, is indicated to us, if not exactly determined.

Every one must have observed decayed wood. Whether the decay goes on by the process of *dry* or *wet* rot, it is still a case of slow combustion. The carbon is attacked by the oxygen—that, in every way wonderful gas, which is at once the supporter of life and light, and the destroyer of all things. By this combination a gaseous acid—carbonic acid—is formed and expelled, leaving, relatively, an increased quantity of carbon behind. Thus we have dark and dusty rotten wood in the works of art, and we have *brown coal* or lignite, in which the woody structure is preserved, in the products of nature. Chemistry shows us the kind of change which takes place; and although it does not explain to us the conditions under which the change occurs, it gives us an intelligible result:

	Carbon.	Hydrogen.	Oxygen.
Wood contains...........	49.0	6.0	45.0
Lignite "	60.0	5.9	31.4
Coal "	80.0	5.3	14.7

With this chemical evidence in support of the hppothesis that coal is altered vegetable matter, let us proceed to the examination of the physical conditions under which it was formed.

Geological research indicates a period in the history of our own land when the sea washed around an extensive group of low islands, formed of the older granitic and slaty rocks, from the waste of which the old red sandstone rocks were forming. In the course of ages these almost land-locked seas became shallower, and the deposited matter arose around the margins, towards the surface of the waters. Myriads of strange and beautiful fish sported in the waves which glowed with the reflection of a sun tropical in the intensity of its light and heat. On the slopes of the shores the coral animals were working in those days, as they are now laboring in the Pacific Ocean, forming their calcareous cells, so beautifully preserved in the limestones of Derbyshire and Devonshire.

Thus, by the wearing down of the land, and by the active agencies at work in the waters, vast tracts of low, swampy lands were formed.

These vast morasses, and the shallow waters of widely spread lagoons, became the abodes of a wild, a strange, vegetation. Tree ferns rose high into air and spread their fronds so thickly that deep shadow reigned forever in the groves. Hosts of smaller ferns almost infinite in variety, luxuriated in those shades—succulent plants, like the sigillaria and club mosses abounded; and other mosses and fungi covered the damp ground. Vegetable life was abundant—to a degree which we can scarcely realize. Amongst these teeming organisms, one of the most remarkable is the plant known as the *Siggilaria*. "They are generally," says Dr. Hooker, "but a few feet high, though sometimes two yards broad at their expanded bases; they are truncated at the top. * * * So common are they, that I have, in many South Wales and other collieries, counted five or six in the space of a few fathoms, always suggesting the idea of the erect stumps of trees in a forest." *Stigmaria*—long, serpent-like roots, shooting off from a centre into the mud in which they grew—were once thought to be a peculiar, a distinct, form of vegetable growth. They are now ascertained to be the roots of the *Sigillaria*.

These plants appear to have been of a very lax fibre. They grew, in all probability, to an enormous size with great rapidity, and as speedily decayed—forming and adding to the mass of *humus* which fed the mighty grasses, ferns and mosses, clustered and matted round the larger trees.

Vast swampy plains like those were thickly spread with the *Sigillaria*, sending their vast roots far over the mud, to absorb speedily the water required for their rapid growth. Graceful *Lepidodendrons* grew in abundance—these were gigantic arborescent club mosses, bearing, at the ends of their graceful leaves, their cone-like fruit.

There, again, were vast spaces covered with huge "horse-tails"—the *Esquisetum;* and on the soft, marshy silt of the river's edge and estuary, grew forests of reeds—*Calamites*. Ferns and mosses combined with these, and formed a mat of vegetation wich rapidly filled the shallow water. Floating in the deeper parts were found the *Asterophylites*. There were numerous varieties of this plant, all of them remarkable for their graceful forms, and apparently all growing in water sufficiently deep to float their branches and leaves. Under the influence of strong solar excitation, the vital powers of vegetable nature were stimulated to the highest. This was also quickened by a high terrestial temperature. We have evidences proving to us "that, in the ancient world," to quote the worlds of Humboldt, "exhalations of heat, issuing forth through the many openings of the deeply-fissured crust of the globe, may have favored, perhaps for centuries, the growth of palms and tree ferns, and the existence of animals requiring a high temperature, over entire countries where now a very different climate prevails." There is little doubt that such were the conditions when a teeming vegetable world drew its carbon from the atmosphere, in which it existed in the form of carbonic acid. That, under those conditions—life being at its maximum of power—these plants decomposed the carbonic acid; and, giving back the oxygen to the air, built up with rapidity their woody structures with the carbon thus obtained. These plants died, and decomposed—through the same agencies—as rapidly as they grew, forming dense beds of black matter, which were slowly re-

solved into the state of coal. Contemplate for a moment the length of time required to form a bed of coal such as that which exists in South Staffordshire, having a mean thickness of thirty feet. This is unusual; but even to form a coal bed of but one yard in thickness must have required a long lapse of ages!

It has been somewhat too hastily said that coal is formed directly from wood, and that much of it is found to retain its woody structure. There is, as before stated, great doubt on this point. That wood may be *eventually* converted into coal is admitted—but in changing it entirely loses the form of wood—retains no evidence of fibre. It may, under the influences of heat and moisture, be converted into a bituminous mass, which is eventually consolidated into coal; but we cannot discover any evidence of wood being transmuted directly to coal. The remains of woody trees found fossil in the coal measure strata may be silicified—may become limestone, may be iron ore—certain it is they are never coal. The probability is, that the coal mass itself was produced from cactus-like plants, from club mosses, from peat mosses, or from aquatic plants, either marine or fresh-water.

The vegetable mass, whatever may have been its origin, from which our beds of fossil fuel is derived, may have been formed from plants which grew on the spot where we now find it; and the *under-clay*, as it is called, is supposed to be the soil in which the plants grew; or it may have been removed by the waters in a plastic state, floated out into the deltas or seas, and eventually, in obedience to the law of gravity, have sunk to the beds of the then existing waters.

Knowing that many of these coal beds are several thousand feet below the surface, we have either to suppose—if we adopt the first hypothesis—a gradual subsidence of the earth to the depth at which the coal is now found; or, if we prefer the second, to imagine the filling up of the seas, after the coal has been deposited, by enormous beds of sandstone or of shale. Sir Henry de la Beche describes a section near Swansea having a total thickness of 3,246 feet; in this there are ten principal masses of sandstone, one of these 500 feet thick. They are separated by masses of shale, varying in thickness from ten to fifty feet. The intercalated coal beds sixteen in number, are generally from one to five feet thick—one of them, which has two or three layers of clay interposed, attaining nine feet.—*Memoirs of Geological Survey.*

Taking this instance only, we learn that there have been sixteen different formations of coal; that these have—each one of them—been covered up with hundreds of feet of sandstone and shale. The subsidence of the earth's crust is surrounded with difficulties of no common order—the filling up an ancient sea to the depth of 3,000 feet requires conditions which we can scarcely conceive to have existed — and in either case we seem to require ages of repose, during which a beautiful Flora drank in the sunshine—then cataclysmal action destroying all—followed by ages during which sand was deposited, bearing down with it but little evidence of there being any vegetable life.

Science has advanced far into the secrets of the earth's changes; but let us not deceive ourselves by supposing we have yet heard the voice of Nature proclaiming the true phenomena of our coal formations."—*St. James's (London) Magazine.*

TRANSMISSION OF GOODS ON THE PNEUMATIC PRINCIPLE.

Some experiments on a rather large scale were recently made on the right bank of the Thames, and immediately below the Railway bridge, Battersea, with a view of testing the efficiency of transmitting goods and parcels proposed by the Pneumatic Dispatch Company. The mechanical arrangements in connection with the experimental line of cast-iron tubing—which, like a huge black snake, stretches for more than a quarter of a mile along the river side—are few and simple. Under a temporary shed a high pressure steam engine, of thirty horse power, made by Watt & Co., and having its cylinder placed at an angle of forty-five degrees, is erected, and it gives direct motion through the medium of a crank to a large disc of sheet iron.

The disc runs on tumbler bearings, and narrows from about 2 feet 6 inches in breadth as its centre to 3 inches as its circumference, its diameter being 18 feet. Its interior contains four arms, to which the sheets of iron are fastened, and which serves as fans or exhausters. Through the hollow bearings, upon which the disc is made to rotate at a speed of from 150 to 200 revolutions per minute, a communication exists with a vacuum chamber below, and by the laws of centrifugal action the latter is speedily exhausted, to a certain extent, of air. The speed, in fact, of the disc, determines that extent, and a water Barometer registers it. The air rushes out with considerable force from the periphery of the disc. Between the vacuum chamber and the pneumatic tube, which is 2 feet 9 inches high, by 2 feet 6 inches in breadth, and a transverse section of which resembles that of the Thames Tunnel, there are fitted valves with hand levers for opening and shutting them. These may be said to comprise the whole of the motive and propelling agencies of the pneumatic system.

The tube has been laid down in Battersea Fields, in such a manner as to test severely the practicability of the scheme. It has several very sharp curves and steep gradients throughout its length, and it is socket-jointed, so as to leave its interior, which is just as it came from the sand, free from obstruction. The carriages are five feet in length, of sheet iron, and each turns upon four cast iron wheels of eighteen inches in diameter. The rails—so to speak—are cast in the bottoms of the tubes, and require, therefore, no 'laying' but that which the setting of the tubes themselves give them. A few strips of vulcanized india rubber screwed round the circumference of the face of the carriage constitutes the piston. This, however, by no means closely fills the tube. In fact, there is fully three-eighths of an inch clear between the exterior of the piston and the interior of the tube.

There is no friction, therefore; and, singular to say, the leakage of air does not interfere with the speed of transit. This can only be accounted for by the large end area which the carriages have, in comparison with the small area of leakage space and the comparatively low vacuum required. On Wednesday last the first experiment made was by loading a carriage with one ton of cement in bags, and entering it into the open end of the tube. Upon a given signal the engineer to the company causing the starting valve to be opened, the water barometer showing a column of seven inches in height, and the disc running at the rate of one hundred and fifty revolutions per minute.

In fifty seconds after, the carriage with its contents found its way into the engine house, through a door at the end of the tube, which it forced open, and then ran forward on rails to a butt placed to stop its progress. Next, two tons weight were placed in one of the carriages, and its transit occupied eighty seconds, under similar circumstances. The vacuum was now lowered until the barometer gauge showed two inches of water only, and a living passenger, in the shape of a not very handsome dog, was placed with one ton weight of dead stock, in a carriage. The signal was made by the workmen at the open end of the tube, the communicating valve was opened, and in one minute and a half the carriage and its four-legged guard were in the engine-house, the latter apparently not at all the worse for the exhaustion process to which it had been subjected.—*From the London Mechanic's Magazine.*

A SUBSTITUTE FOR GLUE—VEGETABLE ALBUMINE.

An improved process has been invented by E. Hanon, of Paris, by which he obtains vegetable albumine from gluten, for the purpose of applying it as a cheap agent for fixing printed colors on textile fabrics, and also for uniting pieces of wood, leather, &c. The following is the substance of the specification, as published in *Newton's London Journal of Arts:*—

Gluten is obtained by kneading wheat flour paste with water. During the operation of kneading, the feculent part of the paste is carried off with the water, and the glutinous parts unite and form an elastic substance called gluten, which contains about twice its weight of water; the gluten, in this state, is converted into albumine, by the process of fermentation.

In carrying out the invention, gluten of the best quality, free from fecula, and after having been well washed in warm water, is placed in vessels, in which it is left to ferment until it is completely soft, and has lost its elasticity, and until the greater portion of the water which it has taken up during the operation of kneading is combined with it; when the gluten has undergone the regular fermentation or modification, it offers no resistance to the finger, or to any article which may be passed through the mass, and the modified gluten should also adhere to the object with which it is brought in contact. The gluten, so modified, is then ready for use; but as it has been brought, by the process of fermentation, into a very thin paste, it is necessary to place it in moulds for drying.

The process of fermentation may be performed, either with or without the aid of artificial heat; when artificial heat is applied, the process is considerably expedited, and the heat found most beneficial is about 20° to 30° Fah., above the temperature of the surrounding atmosphere. During the fermentation, it is requisite to stir the gluten frequently, and to remove the water which rises to the surface. With the above temperature, and in operating upon about fifty or sixty pounds of gluten, placed in a vessel, the fermentation will be sufficiently advanced in three or four days, and the fermented gluten or vegetable albumine, will then be in the proper state for being made into thin plates and dried. The greatest care must be taken that the fermentation is stopped at the proper point, for if it is allowed to proceed too far, the gluten is converted into a noxious mass.

When the gluten is converted into vegetable albumine, it is divided, and formed into plates of about one quarter to three-eighths of an inch in thickness; this is effected by spreading the albumine in metal or other molds, by means of a spatula; it is then left to dry, either in the open air, or by the aid of a gentle heat, and the plates, when dry, are about one-eighth of an inch in thickness.

The process of converting gluten into vegetable albumine may be accelerated in the following manner:—The gluten is put into a vessel or boiler, and heated by steam, or in a water bath, but the heat must only be sufficient to soften the gluten, and should vary from about 105° to 140° Fah. The gluten combines and unites with the water which became incorporated with it in the operation of kneading; part of the water is, however, evaporated during the process of fermentation, and thus the time required for drying the modified gluten, in the manner before described, is reduced. The water and gluten, when united, form a perfectly homogeneous mass of a thin pasty consistency, which is removed from the vessel, and dried, as before described; or the drying chamber may be heated by steam, care being taken that the heat is very moderate. When dry, the vegetable albumine takes up the greater part of the water which it has lost through evaporation during the process of desication. In order to dissolve it, it is put to steep, for about forty-eight hours, in cold water, and, by preference, in soft water; during this time it should be frequently stirred. Before being used the liquid should be diluted with water, and well stirred and shaken up, so that the whole mass or solution is perfectly homogeneous. The quantity of water for dilution must be regulated according to the purpose for which the solution is required. One pound of the so-called vegetable albumine to one pound and a half of water will give a solution which may be used as a substitute for the strongest glue or gelatine, and which resists moisture to a great extent, and is not influenced by heat.

The solution may be used cold, and will retain its properties from ten to fifteen days in summer, and twice as long in winter; that is to say, if it is kept cool, and, if possible, in a current of air.

This vegetable albumine is applicable, first, for uniting pieces of wood, in lieu of glue or gelatine; secondly, for uniting pieces of porcelain, earthenware, glass, enamel, and other similar articles; thirdly, for uniting pieces of leather, skin, linen, paper, pasteboard, and other similar substances; fourthly, for rectifying, clarifying, strengthening, preserving, and generally improving malt liquors; fifthly, for sizing paper and warps; sixthly, for sizing, dressing, stiffening, and thickening every description of woven fabrics and silks, instead of, or combined with, animal gelatine, gum, dextrine, fecula, or other substances; seventhly, for fixing all colours, except ultramarine blue, in printing fabrics; it is requisite to add from ten to twenty-five per cent. of acetic acid, of the strength of seven or eight degrees of Beaume's hydrometer, to the vegetable albumine, which is then thickened in the ordinary manner with fine wheat flour, starch, fecula, or dextrine of wheat; care being taken to boil the same from ten to thirty minutes, according to the degree of concentration, and the consistence of the

color required. Before use, the mixture should be allowed to cool sufficiently to avoid coagulation. For ultramarine blue, a little ammonia is used, instead of the acetic acid; the vegetable albumine must then be dissolved in, or combined with, a solution of slacked lime or phosphate of lime or magnesia. Eighthly, as a mordant for fixing colors in dyeing; ninthly, as a means of fixing gold or other metal leaf on to fabrics, leather, or other materials. In this case, the vegetable albumine, in the form of a dry powder, is rubbed or spread on the surface of the fabric or other material; the gold or other metal leaf is then placed over the part to be figured, and it is fixed thereon by the pressure of a heated die or roller, on which the design is made in relief, The metal may be applied in any other form, instead of in leaf.—*Scientific American.*

OCEAN TELEGRAPHS.

The Geographical Society, popular and very prosperous, (for at each of its fortnightly meetings a score of members are added to the 1,400 already enrolled,) met recently. The main subject discussed was the North Atlantic electric cable. We may offer a few observations on this subject. The discussion arose out of papers read at the preceding meeting by the persons who conducted the survey by land and sea from Scotland to Labrador, and when we say that these persons were Sir Leopold McClintock, Captain Allan Young and Dr. Rae, it is the same as saying that it was performed with skill and intrepidity. But the practicability of connecting the Old and New World by an electric cable is a very different matter from a survey. Schemes as feasible, and even a good deal more so, have totally failed; but the reader shall judge for himself when we enumerate a few of them. First, then, the great Atlantic cable has been a great failure, and has cost the subscribers, as far as we can understand, £450,000; the pounds and cable are equally at the bottom of the Atlantic. The next attempt was a greater, because a more costly failure. This was the Red Sea and Indian affair. It was to have brought the Nile and the Indus almost within hail of each other, although the distance between them was little short of 1,700 miles. For this adventure the government has given a guarantee of 4½ per cent. on a million sterling for half a century, or, in other terms, the nation is for that long time to pay an annuity of £45,000 without receiving the smallest consideration in return. It never conveyed even a single message throughout, so that, as far as the nation is concerned, the million sovereigns might as well have been consigned to the sea that swallowed up Pharaoh, his horses, his chariots and his horsemen. In the able debate which took place in the House of Commons. an honorable member naively and drolly ascribed the failure "to certain occult causes at the bottom of the sea, which could not be provided against." Our next speculation was meant to connect England with Spain by Falmouth and Gibraltar, and the government bargained in this case for a first-rate cable at the cost of some £400,000, but the Atlantic being deemed too deep for it, it was transferred to Rangoon and Singapore, a distance of 1,200 miles, embracing the best part of the Bay of Bengal and the whole of the Straits of Malacca, among a hundred isles, islets and coral reefs. The ship bearing it was wrecked in Plymouth harbour, when the cable was discovered to be damaged by the corrosion of the iron and the decomposition of the gutta percha. It was not, therefore, deemed good enough for the Indian Ocean, and it is now destined to connect Malta with Alexandria; all the cables of the Mediterranean, whether English or French, having already failed. If we include the cable which was to have connected Malta with Spezzia, through Sardinia and Corsica, and that which was to have connected Malta with Corfu, both of which have failed, we have spent not less than two millions in experimenting upon oceanic cables. But we are not the only people who have failed in a matter of long cables. The cable that was to have connected Algeria with France will not work, although it embraces but the breadth of the Mediterranean. The Dutch laid down a cable between Batavia and Singapore about six months ago. The distance is 660 miles, and it conveyed, like the great Atlantic cable, a few messages, when it stopped. Ships' achors and coral reefs were fatal to it; it has broken a score of times, and has been finally given up as a hopeless project. Such, then, being the result of our experience of oceanic electric cables, what chance of success can there be with a cable that purposes to bring the Old and New World together by the route of Scotland, the Faroe Islands, Iceland, Greenland and Labrador, over seas infested by icebergs, and along ice-bound coasts? We fear none whatever. The distance is little short of that across the South Atlantic. There are sea-gaps of 800 and of 500 miles, and the inhospitable land is rather an hindrance than an advantage. We are, then, decidedly of opinion that a North Atlantic cable is a hopeless project that will not be, and ought not to be attempted. The government, goaded on by the press and the public, has been already severely bitten, and will assuredly not guarantee a farthing. Without its guarantee there will as assuredly be no subscribers. Until some great discovery is made which no man at present even dreams of, our electric cables must be confined to the narrow sea, and the wafting of "sighs from India to the Pole" must be still an achievement known only in the domain of poetry.—*Examiner.*

THE RUSSIAN TELEGRAPH FROM CHINA TO EUROPE.

It is an established fact that mercantile houses of long standing in the East are very conservative in their ways, and views with little favour, the innovations caused by steam and electricity. Lieutenant Waghorn, the pioneer of the overland route to India, found small acceptance when he visited Canton in 1838, and proposed to British merchants the formation of the line afterwards made by the Peninsular and Oriental Steam Navigation Company; and had Chinese affairs remained as they were—had there been no opium war, no Hong Kong under British rule—it is more than probable that we should not to this hour have had a line of mail between this and Suez. Bearing this conservatism in mind, it seems problematical whether the proposed line of telegraph between China and Russian Europe is not deemed by leading merchants here a nuisance rather than a good. This telegraph way, according to late advices, is making rapid progress and is already complete over some 600 miles to the eastward of Moscow, viz., to Perm, on the border of Siberia, say to long. 55 deg. E. and lat. 58 deg. N. From

Perm the line will cross the Uralian Mountains to Ickaterinberg, and thence to Toumain on the left bank of the Irtysch. From Toumain the line is to run to Omsk, a fortified town, the importance of which may be judged by the circumstance of its having a garrison of 4,000 men. From Omsk the line will proceed to and through Tomsk and on to Krasnoyarsk. This place is only 500 miles north-west of Kiakhta, to reach which, however, the wire will pass through Irkutsk, the capital of Eastern Siberia. From Kiakhta, (Mai-matsin, in China,) it is proposed to carry the line over the Yablanovoi Mountains to Cheta, to which place steamers already run from Nicalouski, on the Amoor. The line will not follow the line of the Amoor River, however, but across to Nestchmisk, and then down the Shilka River to Ourstrelka, a point just 6,000 miles from Moscow. How long it will take to construct the whole line we are not in a position to say; two or three years perhaps. Once constructed, however, the terminus on this side will become a place of note, and prove a leading instrument in the steady march of civilization in the East.—*Friend of China.*

THE BESSEMER PROCESS OF MAKING STEEL.

Hematite pig-iron, smelted with coke and hot-blast, has chiefly been used. The metal is melted in a reverberatory furnace, and is then run into a founder's ladle, and from thence it is transferred to the vessel in which its conversion into steel is to be effected. It is made of stout plate iron, and lined with a powdered argillaceous stone found in this neighbourhood below the coal, and known as ganister. The converting vessel is mounted on axes, which rest on stout iron standards, and by means of a wheel and handle it may be turned into any required position. There is an opening at the top for the inlet and pouring out of the metal, and at the lowest part are inserted seven fire-clay tuyeres, each having five openings in them; these openings communicate at one end with the interior of the vessel, and at the other end with a box called the tuyere box, into which a current of air from a suitable blast engine is conveyed under a pressure of about 14lb. to the square inch, a pressure more than sufficient to prevent the fluid metal from entering the tuyeres. Before commencing the first operation, the interior of the vessel is heated by coke, a blast through the tuyeres being used to urge the fire. When sufficiently heated, the vessel is turned upside down, and all the unburned coke is shaken out. The molten pig iron is then run in from the ladle before referred to; the vessel, during the pouring in of the iron, is kept in such a position that the orifices of the tuyeres are at a higher level than the surface of the metal. When all the iron has run in, the blast is turned on, and the vessel quickly moved round. The air then rushes upwards into fluid metal from each of the thirty-five small orifices of the tuyeres, producing a most violent agitation of the whole mass. The silicum, always present in greater or less quantities in pig iron, is first attacked. It unites readily with the oxygen of the air, producing silicic acid, at the same time a small portion of the iron undergoes oxydation, hence a fluid silicate of the oxide of iron is formed, a little carbon being simultaneously eliminated. The heat is thus gradually increased until nearly the whole of the silicum is oxydised; this generally takes place in about twelve minutes from the commencement of the process. The carbon now begins to unite more freely with the oxygen of the air, producing at first a small flame, which rapidly increases, and in about three more minutes from its first appearance we have a most intense combustion going on; the metal rises higher and higher in the vessel, sometimes occupying more than double its former space. The frothy liquid now presents an enormous surface to the action of the oxygen of the air, which unites rapidly with the carbon contained in the crude iron, and produces a most intense combustion, the whole, in fact, being a perfect mixture of metal and fire. The carbon is now eliminated so rapidly as to produce a series of harmless explosions, throwing out the fluid slags in great quantities, while the union of the gases is so perfect that a voluminous white flame rushes from the mouth of the vessel, illuminating the whole building, and indicating to the practised eye the precise condition of the metal inside. The workman may thus leave off whenever the number of minutes he has been blowing and the appearance of the flame indicate the required quality of the metal. This is the mode preferred in working the process in Sweden. But here we prefer to blow the metal until the flame suddenly drops, which it does just on the approach of the metal to the condition of malleable iron; a small quantity of charcoal pig iron, containing a known quantity of carbon, is then added, and steel is produced of any desired degree of carburation, the process having occupied about twenty-eight minutes from the commencement. The vessel is then turned, and the fluid steel is run into the casting ladle, which is provided with a plug rod covered with loam: the rod passes over the top of the ladle, and works in guides on the outside of it, so that, by means of a lever handle, the workmen may move it up and down as desired. The lower part of the plug, which occupies the interior of the ladle, has fitted to its lower end a fire-clay cone, which rests in a seating of the same material let into the bottom of the ladle, thus forming a cone valve, by means of which the fluid steel is run into different sized moulds, as may be required, the stream of fluid steel being prevented by the valve plug from flowing during the movement of the casting ladle from one mould to another. By tapping the metal from below, no scoria or other extraneous floating matters are allowed to pass into the mould.—*Chemical News.*

PROPOSED OPENING OF THE BRITISH MUSEUM TO THE PUBLIC BY GAS-LIGHT.

To the great masses of our working population, this Institution, on which millions have been expended, and which is kept up by a large national expenditure, is at present far too little available as a place of recreation and instruction. On the few holidays which occur at Christmas, Easter, and Whitsuntide, we see crowds of workingmen and their families, gladly availing themselves of these rare opportunities, and no doubt some good is effected by those visits; but in these days of advanced intelligence, the British Museum should be devoted during seasonable hours, to the uses of the many thousands of young men and others who are using earnest endeavours for their advancement and improvement. To many of these the opening of this collection in the evenings, up till say 10 o'clock, would be a very

great advantage: besides this, to the public generally, it would afford an opportunity of viewing the rare treasures and curiosities which have been gathered here at so much labor and cost. For these and other important reasons, therefore we regret that the trustees have resolved that they would not be justified in allowing the collections of the Museum to be opened at any hour which would require gas-light.

Upon first considering the resolution which has been come to by the trustees, most persons will experience astonishment and some alarm at the late Mr. Braidwood's account of the inflammable nature of a building which has been erected by so large an outlay in our own days. By that gentleman's report, this museum—which contains priceless treasures of the world's art, objects, which, if destroyed, could never be replaced; the rare manuscripts, the chronicles of history, and the stories of old and new world learning, the real value of which cannot be estimated by any standard of price; the records of the famed cities of antiquity, whose glories have for centuries been laid in the dust; the relics of dynasties which have passed away; and examples of the arts of many ages, which are so useful to the historian and artist; the collection of objects of natural history; the store of prints, drawings, &c.—is, if it would be exposed to danger from gas-lighting, at any time liable, even at present, to risk from neglect, accident, or a spirit of mischief. These are uncomfortable reflections, and cause persons to inquire how it has occurred that a building intended for such purposes, has not been so constructed as to be perfectly safe from the danger of fire. At the present time there are steam-works and fires below for the purpose of heating and ventilating the new reading room, print room, &c.: there are also fire stoves in the manuscript and other departments, and in the private rooms of the officers. We mention this for the purpose of suggesting that if the shadow of risk exists of the burning of the contents of the Museum, no time should be lost in making those alterations which will prevent gas-light, or any other kind of light, from doing damage. The floorings, such as that of the King's library, the bookcases, staircases, (if any such exist,) rafters, or other inflammable parts of the structure, should, without delay, be removed, and others of a more safe description substituted.

While acknowledging the great experience of Mr. Braidwood, in connection with fires, we cannot admit that any great extra amount of danger would result from the lighting of the British Museum with gas, provided that this is carefully and properly managed; and, in fact, unless the electric light should become available, by means of the experiments which are constantly being carried on by men of science in various parts of the world—without the use of gas, the British Museum will not become a means of enlightenment to the artizans and numerous other classes of the metropolis who cannot spare the working hours for the purpose of pursuing those studies which would advance them in skill and intelligence.

At the Kensington Museum, gas-lighting is used with safety and good effect.

It will be impossible to oppose for much longer the strong voice of public opinion on this subject: the intelligence of the people is rapidly improving; and means must be taken to render such establishments as the British Museum accessible at hours convenient to the industrious classes of London.—*London Builder.*

Miscellaneous.

The British Census of April, 1861.

The population of Great Britain was estimated at 7,392,000 in 1751.

The population of Great Britain was then enumerated in 1801, and amounted to 10,917,000, and with that of Ireland united with her, made above 16,000,000. Notwithstanding the war the population increased, as the census showed, at the rate of two to three millions every ten years until 1841. Then immense emigrations took place; there was a depopulating famine in Ireland, which had an imperfect poor law, and cholera was epidemic; yet the population of Great Britain was augmented by 2,308,000, and although the population of Ireland fell off, the people of the United Kingdom amounted to 27,724,000 in 1851. There will be no investigation as to the "religious profession" of any one. That inquiry, when proposed last year, having been met with general disapproval, was abandoned by the government.

Vital Statistics of Scotland.

The Registrar-General for Scotland, who has hitherto issued no detailed annual reports, has just commenced the series, beginning with his first year of office, 1855. Taking first the births, the superintendent of statistics calls attention to the circumstance that the proportion of boys born to girls is greater in the rural districts than in the towns, in which, indeed, in that year, the illegitimate boys born were absolutely fewer in number than the girls. This is attributed to a residence in towns weakening the physical strength of parents, and it is considered a rule so established as to "afford a valuable hint to those who desire male progeny." It would appear from the year's returns, that, though marriages are much fewer in Scotland than in England, yet, when Scotchwomen do marry, they are much more prolific than the English. Some rather curious matrimonial statistics are supplied. It is remarked that widows, marrying bachelors, selected, as a general rule, husbands younger than themselves; "the *status* which the widow had acquired by her former marriage presented inducements to the unsettled bachelor, which gave the widow a great advantage over her unmarried sisters; and, as power is dear to every heart, a younger member of the opposite sex was selected, as more likely to leave that power in her hand than if the chosen second husband had been her senior in years." The Scotch stand the educational test well; 86.6 per cent. of the men who married, and 77.2 of the women signed their names. In England, in the same year, the proportions were 70.5 and 58.8 The deaths in the year (a year of more than average mortality) were only 206 deaths in 10,000 persons, showing Scotland to be one of the very healthiest countries on the face of the globe. The annual per centage of deaths to population is stated thus: Scotland, 2.06; England, 2.21; France, 2.36; Belgium, 2.52; Holland, 2.76; Prussia, 2.83; Spain, 2.85; Sardinia, 2.91. Some points of interest in relation to disease and mortality are noticed. Including the secondary diseases, twice as many women died from childbirth as in England. This is thought not much attributable to distance from medical aid, and the question is raised whether it is not owing to certain anatomical conformations. It

may seem strange to speak of Scotland as a place for the consumptive, but Argyll and the Western Isles enjoy a remarkable immunity from consumption; those islands have a mild winter climate, with a more humid atmosphere than the main land when the arid easterly winds prevail in spring. Of the influence of weather, we learn that in Scotland, with the single exception of diarrhœal complaints, all the ordinary epidemics of the country increase with the increase of cold, and it is the cold that kills. The diseases induced by heat seldom prevail anywhere until the mean monthly temperature rises above 60 degrees, and that is a rare occurrence in Scotland.

Cities in Great Britain.

Liverpool.—The population of Liverpool, in round numbers, is 450,000. The city proper contains but 263,000 persons, the remainder being distributed in the suburbs of Exeter, Kirkdale, West Derby and Toxteth Park. The port of Liverpool has a large floating population of sailors, reckoned in this census at about *fourteen thousand* men. In 1841 the number of sailors was twelve thousand, in 1851 it was thirteen thousand, and in 1861 but one thousand more than ten years ago. The total population of the city and its suburbs, at the census of 1851, was 375,955, so that the increase in ten years has been a little more than twenty per cent.

During the last four years the number of inhabited houses in Liverpool has likewise increased from 54,000 to 66,000. In 1831 the buildings in the town were estimated to cover an area of 6,000,000 square yards, while in 1765 they only covered an area of 1,184,000 square yards.

Manchester.—Manchester has decreased in population, losing 2,000 inhabitants of the city proper by reason of the conversion of dwelling-houses to offices and other business purposes, and alterations in narrow streets. The increase in the townships adjoining that of Manchester is extraordinary, but may be accounted for by the compulsory migration from Manchester arising out of the causes mentioned. The present population of the city and its suburbs is 357,000—a gain of 40.000 in ten years.

The census superintendent in Manchester reports, that while the decrease in the city proper is going on, the conversion of property out of which it arises increases the gross assessment of the township, by better buildings, in a remarkable way. The effect will be to reduce the poundage on the poor and other rates, and eventually to reduce pauperism by the sweeping away of the lower descriptions of dwellings.

Glasgow.—The analysis of the city of Glasgow has been published. The population of the "ancient burg" of Glasgow amounts to 403,142; of whom 189,220 are males and 213,922 are females. The popnlation of the district known as the "ancient burg" and the suburbs is 446,395; of whom 209,999 are males and 236,396 are females. The amount of the population in 1851 was 360,138; thus showing an increase, in 1861, of 86,257. In 1861 the number of inhabited dwellings was 82,600, and of uninhabited, 4,002, compared with 63,153 and 1,547 in the year 1851, being an increase, in 1861, of inhabited dwellings, to the extent of 19,456, and of uninhabited, 2,455. The population is composed of 326,374 Scotch, 10,809 English, 63,574 Irish, 827 foreigners, 1,440 colonists, and 118 not ascertained. The number of males between the ages of five and fifteen, amounts to 40,694, with 40,118 females; and of this number 116,868 males and 16,214 females were not, at the taking of the census, at school. The number of domestic servants within the city was 218 males and 12,856 females; total, 13,074.

Population of the Principal Cities of Europe.

London,	2,950,000
Paris,	1,525,525
St. Petersburg,	494,656
Vienna,	476,222
Berlin,	438,961
Naples,	413,920
Madrid,	301,660
Lisbon,	275,286
Brussels,	263,481
Amsterdam,	248,756
Pesth and Bude	186,945
Rome,	180,359
Turin,	179,655
Hamburg,	171,696
Copenhagen,	113,635
Venice,	118,172
Dresden,	117,750
Munich,	114,734
Stockholm,	101,502

Population of the World.

M. Dietrici, director of the office of Statistics at Berlin, has published in the annals of the academy of that city the result of his researches relative to the present population of the globe. An addition to his calculation of the total number of inhabitants, which he puts down at upwards of 1,288,000,000, M. Dietrici estimates the number of the different human races as follows:—The Caucasian, 369,000,-000; the Mongol, 552,000,000; Ethiopian, (negroes) 196,000,000; the American, (Indians,) 1,000,000; tho Malays, 200,000,000. The leading religions he divides as follows: Christianity reckons 335,000,000 adherents; Judaism, 5,000,000; the Asiatic religions, 600,000,000; Mahometanism, 160,000,000; and Polytheism, 200,000,000. Of the Christian population, 170,000,000 belong to the Roman Catholic church; 80,000,000 to Protestants, and 76,000,000 to the Greek church.

Curiosities of the English Census.

Relative Population of London and the Provincial Towns—Excess of Females in England.—The Registrar-General estimates the number of English emigrants from the United Kingdom in the ten years between 1851 and 1861 at 640,210, and returns the number of registered births over registered deaths in the same period at 2,260,576. This would leave an increase of 1,620,366, but the actual augmentation enumerated on the 8th of April was 2,134,116, showing that 513,750 births must have passed unregistered in the ten years. It appears that the population of London is nearly equal to that of the twenty leading provincial towns, having a population of 70,000 and upwards—Bolton, Birmingham, Bradford, Brighton, Bristol, Hull, Leeds, Liverpool, Manchester, Newcastle, Norwich, Nottingham, Oldham, Portsmouth, Preston, Salford, Sheffield, Stoke-upon-Trent, Sutherland and Wolverhampton, all put together—the metropolis having 2,803,034 inhabitants, and the great provincial centres, 2,963,945. The population of the latter is, however, increasing more rapidly than that of the metropolis, the aug-

mentation having been 440,798 in London, as compared with 591,058 in the provincial towns, so that Cobbett's "great wen," is not, as some assume, absorbing all the power of the State.

With regard to forty-three secondary towns, the population of which ranges between 20,000 and 50,000, an advance has been made from 1,414,093 in 1851, to 1,653,386 in 1861, showing an augmentation of 239,293; and one hundred and seven still smaller towns, including, as in the case of their larger brethren, the additions made to many of them for parliamentary purposes, having a population of from 5,000 to 20,000, had in 1851, 954,038, and in 1861, 997,389 inhabitants, showing an augmentation of 43,351. The metropolitan district consequently increased in population at the rate of eighteen per cent.; the great centres of manufacturing industry at the rate of twenty-four per cent.; the second class towns at the rate of seventeen per cent.; and the little boroughs at the rate of four per cent. In fourteen still smaller townships, having less than 5,000 inhabitants each, the population remained all but stationary, being 52,108 in 1851, and 52,559 in 1861; so that the lower one gets in the scale the more stagnant one finds the tide of human life.

The excess of the fair sex in England amounts to the alarmingly large total of 544,021; but this disproportion between the sexes is not universal, the rougher section of humanity being in a majority in Derbyshire, Durham, Essex, Herefordshire, Kent, Hampshire, Staffordshire and Westmoreland. In Middlesex there 165,389, and in Lancashire, 86,100 more women than men, and the agricultural counties also reflect the continuous drain of emigration upon their adult male population.—*London Times.*

Canadian Timber for France.

A contributer to the January number of the "*Annales Forestieres et Metallurgiques,*" a Parisian magazine of a semi-official character, writing under the heading of "*Les bois de Canada,*" speaks of the decline of the timber exports of Norway, and of the impossibility of obtaining from thence the wood necessary for manufactures in France, and says:

"Everybody knows that our former colony is, so to say, a vast forest of four thousand leagues square, possessing as means of transit magnificent lakes and rivers, and in which whole armies of wood-cutters, or 'lumberers,' as they are called, cut down every year from eight to ten millions of cubic metres of timber, the greatest part of which is exported to the United States, and more particularly to England."

He goes on to argue in favor of exchanging for Canadian lumber the staple products of France, her wines, her porcelain, her silks, woollens and cottons, and above all, her "*tabac de-ccporal,*" which, he remarks, is "the delight of French Canadians."

Basswood.

In the United States, basswood is used to a considerable extent for seats of chairs, insides of drawers, parts of fanning-mills, and many other uses for which it is better adapted than almost any other wood. It is both light and strong, works easily and is not apt to split.

Basswood is one of the most abundant woods in Canada, but it has so far received little or no attention in commerce. The Quebec *Advertiser* urges that efforts be made to promote the export of basswood lumber, and also the manufacture for export of wooden-ware made from basswood.

In England a great business is carried on in the manufacture of white-wood ware, or Tunbridge-ware, and for such purposes, any wood which will "dry white" is used—the principal kinds being 'chestnut' —*i. e.*, horse-chestnut, a very different wood from the common chestnut, (*castanea vesca*)—and lime, or, as we call it, basswood. Referring to this, our Quebec contemporary considers that a good business might be done in exporting this wood to England.

For use in wooden-ware this wood must not be exported in logs, as in that state it can only be employed for the upper timbers of houses, ships, etc. But it must be exported in the shape of boards, inch, half-inch, and even as thin as the eighth of an inch, for veneering. The great object is to get the wood to dry white, and to secure this, it must be sawn quite fresh, and before the sap has had time to ferment, and thus discolor the wood. The boards are taken from the saw-mill or pit as fast as they can be cut, hung up under shelter from the rain, in an open shed, with a free draught of air, (not in piles,) until so thoroughly dry that there is not the least probability of their becoming mildewed. There would be still more profit to Canadians if they themselves should convert their basswood into articles of wooden-ware, with which Canada probably could supply the world.

On White Gunpowder.*

Having lately prepared different samples of white gunpowder (according to the receipt of Dr. J. J. Pohl, given in the *Chemical News*, July 6) for some military engineering experiments, I have tried the process of separately grinding the materials, viz., chlorate of potash, ferrocyanide of potassium, and cane sugar, and then mixing them; also grinding them together with a little water added, and then dried at a temperature of about 150°. I find that those samples which were prepared moist and then dried are more easily exploded than those prepared by the dry process. In fact, one sample exploded in an open porcelain dish by simple friction with a spatula with which one of my assistants was crushing some of the larger pieces. Through the explosion he was laid up for several weeks, and nearly lost his eyesight. No samples prepared dry are as explosive as those prepared moist, the addition of water causing a more perfect mixing of the particles of its chemical constituents than can be effected by the dry grinding process. This accounts for the greater danger attending the use of white gunpowder prepared in the moist way.

A cannon loaded with the white powder goes off on the application of a few drops of sulphuric acid (equally as well as with a light applied) to its touch hole.

This property of the gunpowder may possibly be applied to some advantage in the construction and preparation of bomb shells for long ranges. The shells would not explode (if filled with the white powder and containing a glass vessel with sulphuric acid) until they struck the object. No useless explosion of the shell could take place in the air, as is too often the case with the ordinary fusee shell.

Its expansive or explosive force is also twice that of common gunpowder. In all experiments performed with this white gunpowder care must be

* By F. Hudson, Esq.

taken not to compress it too violently; otherwise accidents may frequently occur. A blow with a hammer upon stone with some of the powder upon it explodes all samples that I have prepared.—*Chemical News.*

Manufacture of Malleable Horn.

A patent has been taken out in France, by Messrs. Boulet, Sarazin & Co., for a new process for making malleable horn. The horn, in chips and shavings, is boiled a long time in a caustic lye of strength of 25° of the alcalimeter, by which it is entirely melted. This liquid is then reduced for evaporation to a plastic paste, which may be rolled into sheets, drawn into rods, or molded in any form.

This paste is rendered more strong and elastic by mixing it with india-rubber or gutta-percha. The substances are mixed together in a cast iron vessel, and passed between fluted revolving rollers, the vessel being heated by steam.

The inventors say that, by covering the fibers of cocoa or of aloes with this paste, they have obtained belts more solid than those of leather, and stronger than those of india-rubber.

Steam Shipping of Great Britain.

Mitchell's Steam Shipping Journal states that the Parliamentary returns have been published, giving the names of all steamships in Great Britain on Jan. 1 1861, with their tunnage.

The total number of steam vessels is 1,945. Gross tonnage, 686,417 tons; exhibiting an increase of 82 ships and 19,904 tons over 1860. Of the ships thus registered, there were—

Paddle wheels	1,342
Screw	601
Screw and paddle	1
Experimental propeller	1
Total	1,945

Again: specifying material there were—

Built of wood	860
Built of iron	1,080
Built of steel	5
Total	1,945

The distribution in some of the principal ports was as follows:—

	Steam vessels.	Tons.
London	525	276,133
Liverpool	214	91,662
Newcastle	116	19,445
Hull	66	26,007
Sunderland	71	13,304
Shields	132	8,830
Southampton	33	8,407
Bristol	66	7,416

Formation of Fumic Acid.

The formation of fumic acid, so important, apparently, to the nutrition of plants, has received a long investigation at the hands of M. Paul Thenard, the discoverer of it (*Bulletin de la Société Chimique de Paris*, No. ii. page 33), who has come to the conclusion that it is a compound of ammonia or certain ammoniacal salts with vegetable principles. He wetted straw, dry leaves and sawdust with ammonia, and the carbonate and sulphate, and found that it was formed in abundance. He found, also, that when glucose, or sugar, was heated in a tube nearly to the temperature at which it decomposes, and a current of ammoniacal gas was passed, a large quantity of the ammonia was absorbed, and substances produced greatly resembling fumic acid. That formed from glucose was of a brown colour, was soluble in water, acids and alkaline solutions, but insoluble in alcohol. That formed from cane sugar was brown, uncrystallizable, soluble in alcohol and insoluble in water. Carbonic and the other acids dissolved it freely, and alkalies precipitated it from the solution. Another body formed with the last had similar properties, but was insoluble in alcohol. The analyses of these three bodies gave the following results:—

	I.	II.	III.
Carbon	52.28	65.66	54.26
Hydrogen	6.38	6.05	5.34
Nitrogen	9.94	19.36	18.78
Oxygen	31.40	8.93	21.61

Similar substances to the above were formed when starch, mannite, cane sugar, or sugar of milk, was heated with liquid ammonia in a sealed tube. When syrup was heated with liquid ammonia to 180° Centigrade, carbonate of ammonia, a black liquid and a black solid substance were formed, the two last of a very complex nature. The author speculates on the constitution of these bodies, admitting that he has but incompletely studied them. We do not, therefore, quote his speculations. He mentions a fact, however, which may be of value to some of our readers. A farmer, near Châlons, sprinkles his dung-heaps with ammoniacal gas liquor, and thereby obtains an excellent manure. The gas liquor used in this way producing a much better effect than when applied directly to the soil. M. Thenard examined the dung-heaps and found an abundance of fumic acid, or rather fumate of lime.—*Chemical News.*

Property of Rock Oil.

At a recent meeting of the American Photographical Society, Mr. Seely mentioned a remarkable property of rock oil, namely, its extraordinary power of penetrating capillary tubes. It surpasses in this respect both water and alcohol, and probably all other liquids. It will flow by the wick over a lamp and cover the outside, it will follow up the side of glass and thus escape from a bottle. If put into a wooden barrel it passes through the staves, covering the barrel upon the outside, and filling the air with its odor.

The Copper and Iron of Lake Superior, U. S. side.

The aggregate value of copper exported from the Lake Superior Mines in 1845 was but $390; in 1850 it was $266,000; in 1855 it was $1,437,000, and in 1860 it had increased to $2,944,000. The product of this region for 1860 may be stated as follows:

Copper shipped	$2,944,000
Iron ore (150,373 tons)	400,000
Pig iron (5,650 tons)	150,000
Whitefish and Mackinaw trout	50,000
Furs	20,000
	$3,564,000

To this may be added the trade in cedar posts, ship-timber, and firewood, which is quite extensive.

The three iron companies in operation at Marquette, quarried in 1860 the following amounts:—Jackson mine, 60,000 tons; Cleveland mine, 50,000 tons; and Lake Superior mine, 40,000—making 150,000 tons. The principal points to which the ore is shipped, are (in about the proportion named) Detroit and Wyandotte, Mich., one-twelfth; Cleveland, Ohio, one-half; Erie, Penn., one-third; and the balance to Buffalo, N.Y. Each of the above companies can quarry, with present facilities, 100,000 tons of ore annually. The capacity of the railroad and docks is also sufficient for transporting and shipping that amount.

The toll collected from the tonnage passing through the Sault Ste. Marie canal, the first year it was opened

(1855), was only $4,374; last year it had increased to $24,660. The aggregate value of articles that passed through the canal in 1860 was $12,158,856 94.

Salt Trade of the United States for the year 1860.

The quantity of salt manufactured in the United States during the year 1860, varies considerably from the quantity made the previous year (14,000,000 bus.), amounting to about three-quarters of a million bushels deficiency. The State of New York produced, in the Onondaga Valley, 1,300,825 bushels of salt *less* in the year 1860 than was produced in the same district during the year 1859, and the production of 1859 was 138,947 bushels less than the production of salt in 1858; while, during the same time, the States of Michigan, California and Texas have considerably *increased* their production of salt during the same periods.

Estimated quantity of Salt manufactured in the United States in the year 1860.

Massachusetts	325,000	bus.
New York	5,593,447	"
Pennsylvania	950,000	"
Virginia	3,650,000	"
Kentucky	290,000	"
Ohio	2,050,000	"
Illinois	60,000	"
Michigan	40,000	"
Texas	50,000	"
Florida	70,000	"
California	250,000	"
Utah	60,000	"
	13,388,447	"

The whole amount of salt inspected on the Onondaga Salt Springs Reservation, in the State of New York, during the year 1860, was 5,593,447 bushels, being equal to 1,118,650 barrels of 280 lbs. each. Of this quantity, 1,462,565 bushels have been the product of the Solar Salt Vats, and 4,130,882 bushels, usually termed fine salt, has been made in kettles by boiling.

An experiment has been made the past summer for producing a superior quality of fine salt for table use, and also for dairy purposes, particularly butter-making, adopted partly from the English method, which has proved very successful, and promises beneficial results. This salt is brought to a finer crystalization and a more thorough separation from the impurities of the brine in the kettles than by the common mode, and is afterwards dried by artificial heat, and passed through rollers and seives to bring it to a state of complete pulverization. It is subsequently "medicated," by a patented application, recently discovered, which finishes the process. Salt produced by this method has a clear, dazzling white appearance, is always pulverulent, and retains scarce a trace of impurity. This description of salt, which has received the denomination of "Factory-filled," is admirably adapted to the curing of butter, and will doubtless prove, upon trial, to be equal to the best brands of English salt, of which a very large proportion is sold in this country.

The legislature of the State of Michigan, in 1859, by law declared that there should be paid a bounty of ten cents per bushel on salt manufactured from water obtained by boring in the State; consequently, eight wells have been sunk upon the Saginaw and five at Grand Rapids; and a quality of water has been found which, for strength and purity, is unsurpassed in the United States, and from which very rapid progress is now making in the manufacture of salt.

Total Exports of Salt from the United States during the year 1860.—Bushels, 475,445.—Value, $129,717.

Composition of Friction Matches.

The exact ingredients, and their proportions, in the phosphorus composition, differ in different countries, but they all consist essentially of emulsions or mixtures of phosphorus in a solution of glue or gum arabic. In England the composition contains a considerable quantity of chlorate of potash, which imparts a snapping quality and noisy projecting flames, and but little phosphorus, on account of the moisture of the climate; other substances are also added to give hardness and power of resisting moisture. The following is about the composition of the best quality:—

Water	4	parts by weight.
Glue	2	" "
Phosphorus	1½ to 2	" "
Chlorate of potash	4 to 5	" "
Powdered glass	3 to 4	" "

In Germany the proportion of phosphorus used is much larger, and gum is used instead of glue, together with nitrate or peroxyd of lead, and no chlorate of potash. In consequence of the presence of so much phosphorus and the absence of chlorate of potash, the German matches light quietly, with a mild, lambent flame, and are injured quickly in a damp place by the oxydation of the phosphorus and the production of phosphoric acid, which attracts moisture. One of their mixtures, given by Bottger, is composed as follows:

Phosphorus	4	parts by weight.
Nitrate of potash	10	" "
Fine glue	6	" "
Red ochre	5	" "
Smalt	2	" "

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor wlll exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURES & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics' can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

THE JOURNAL
OF THE
Board of Arts and Manufactures
FOR UPPER CANADA.

NOVEMBER, 1861.

DECORATIVE PAINTING.

Our article on this subject,* we are glad to find, has created some interest among a few of our painters. Several have applied at the free Library of the Board of Arts and Manufactures for works which treat on the subject, and others have expressed a desire for some practical hints that might be useful to beginners. One, a native of Germany, thinking our previous remarks imply a slight on what he seems to consider his national art, has written us a long and discursive letter on the subject, which, had it been in shape for this Journal, we would have gladly published.

The species of decoration to which we alluded as having been introduced into the Province by German painters is no more to be likened to the ancient frescoes of Germany, where such exist in its cathedrals and palaces, than one of our lager bier saloons to the palace of the Alhambra. The pseudo-fresco painting, which has been generally accepted as an improvement on anything which may have preceded it in the Province, we said was "a laudable attempt" to supply a defect in our public buildings, namely, the absence of interior ornamentation. We deprecated the selection of mere architectural details for the purpose of a high style of decoration, at the same time admitting a talent for drawing on the part of those who practised this kind of painting.

We thought it patent to every reflecting mind that painting, architecture, and sculpture possessed distinct aims, and objects frequently combined to produce harmonious effects, but not of necessity to repeat, or reflect each other. Yet, oddly enough, our correspondent advocates his favourite style of ornamentation by claiming for it a superiority, not in point of taste, but a greater economy over similar adornments in plaster. He asks, whether it is not as much a sham to construct cornices, pillars, and pilasters of stucco, which, from the nature of the material, cannot support what they would seem to be intended for, as to represent them by painting; and argues that, if they were properly represented by lights and shadows, the effect would be the same, and would be obtained at much less cost. He says, he could paint a cornice in water colour at one-tenth the price of one in plaster, and in oil, which, he remarks is more durable than plaster, at one-fourth of that cost. It is not strange that the perpetrator of one set of shams should fall foul of another labourer in the same rank field. Were we on the subject of architecture, the plasterer, who is generally a wholesale dealer in shams, would not escape severe criticism. For the present, we have only to do with house painting, and are desirous of pointing out, for the benefit of those who may wish to profit by our remarks, some of the abuses at least of the art, if we do not succeed in defining its proper use.

Truth is said to be the first great principle in art. If we so far forget this important axiom as to pursue a system founded on untruth, we prostitute and debase the art, especially where we lend it for the purpose of apparently implementing architectural construction. We do this when we paint sham pillars, sham cornices, mouldings, panels, and other details, which ought to have been done by the architect in some solid substance. If such things were not necessary, as the fact of leaving them out would tend to show, why not leave the painter to exercise his legitimate calling, where his art might have a fair chance along with that of the architect of being duly appreciated? Surely there are better subjects for the painter's pencil than bad architectural details. If he should be so cramped up in cities that the stones, and bricks, and mortar of our dingy dwellings have crushed out of his mind all other ideas of art, give him a holiday—let him go to the forests and study the autumnal glow of the maple, the rich brown of the beech, the bright sunny yellow of the linden, and let him bring with him armsful of foliage, and paint their graceful fronds. Let him weave them into coronals, and work them into his arabesques. What have we to do with drab, the universal colour with our house painters? Where is it in nature, unless in the buried sandstone; and, when we bring it to light, does not nature kindly shed over it the bright day colours, or the golden sunset, as if ashamed of its unnatural tint?

Drab, however, is the very life and soul of the house painter. It is drab, drab, eternal drab! It came into use with the Puritans, a gloomy and austere race. It has been ever the badge of the Quakers. There must be, indeed, something congenial to sourness and moroseness in *drab*, for we believe that painters, an unusually musical class, are scarce ever heard to sing or whistle at their work under its influence. We can only account for its extensive use on the ground of its comparative cheapness, being more easily adulterated with gross earthy substances than other pigments.

It is a well ascertained fact that colours have peculiar influence on the human mind. Many highly curious and valuable works have been published on the properties and harmony of colour. It is said

* Page 225.

that the inhabitants of countries where bright colours abound in nature, and are introduced into apparel, furniture, and other articles are remarkable for great animation aad liveliness of manner.

In France, and Italy, in many parts of Germany, and even in Holland the humblest domiciles are painted outside and inside in the brightest colours. The more pretentious edifices, especially the ancient buildings, are coloured on the brick and stone work, and occasionally gilded in a highly artistic style. It is often a subject of remark by those who have resided sometime on the continent of Europe, and have become accustomed to colour on buildings and in the dresses of the people, that the absence of colour strikes them on their return as extremely dull and gloomy.

It is surprising with how little apparent effort a pleasing and harmonious effect may be produced, by the judicious application of a few simple colours. Our parlours, drawing rooms, and halls, might, at half the expense of the dull oak graining, be enlivened by a few simple touches of chromatic penciling. It would be far from an undignified employment for those members of families who sometimes occupy their time in painting fire-screens, making wax flowers, &c., to pencil, or stencil in some light running ornament or simple diaper on the panels and architraves, after the woodwork had been previously stained or coated by the house painter. A simple wash of size, coloured with amber or other pigment, on the woodwork is all that would be required previously to the diapering or penciling with colour.

Good examples of this kind of decoration may be found in the illuminations of ancient manuscripts and missals: but there are also many specimens of this art from ancient edifices to be found in modern publications. A few books of an elementary kind treating on the subject may be seen at the *Free Library of the Board of Arts and Manufactures* at Toronto, where catalogues of others may also be found.

The house painter would find an infinite variety of interesting study in prosecuting this most beautiful art. He would have free scope for his imagination. He would not be tied down, as he now is, to the formality of vile oak graining, and marbling, and such like shams; but, while retaining the effect of the ancient work, every variety in the detail might be obtained, and a local interest be imparted to it by working in our beautiful Canadian foliage, where it might be introduced with propriety and effect.

The human figure is doubtless a grand and dignified subject to introduce into mural decoration, but this can only be done effectively by first-rate artists, and should not be attempted by ordinary painters. It is generally admitted that figures in modern costume are inadmissable as wanting in pictorical effect, and being rarely applicable in a symbolic sense. The painter's choice, therefore, lies between the Heathen Mythology and the Christian Calendar. It is questionable whether we, as christian people, are strictly justified in our general preference for the sensual deities of the Pagans; but it is nevertheless true that we invariably adopt them in the embellishment of our music halls, and similar temples of amusement. Christian art admits into its composition angels and saints more modestly clothed generally, and, perhaps, on this account less objectionable than the heathen figures; but we cannot evidently disunite them from particular phases of christian worship, else they would, perhaps, form a better class of subjects for our purpose. Unless for for devotional purposes, however, it may be doubted whether there is much advantage in the use of figures in mural painting. They are rarely well executed. The requirements of taste in this respect are, perhaps, better met by pictures in the usual way.

Legends, or quotations from the poets, or other inscriptions illuminated in the manner of the ancient manuscripts would fill up the panels of our Music Halls quite as effectively as figures of pagan goddesses. They would besides convey generally more intelligible meanings. Any one who has seen good specimens of this kind of writing, can easily imagine how rich and beautiful it could be treated for decoration on a large scale. It might with propriety take the place of meaningless scrolls, which are not unfrequently set up as ornaments for their own sake, not having the least connection with the main subject of the design. This kind of ornamental writing is capable of adaptation to almost every species of decoration—to churches, halls, theatres, saloons, and to private dwellings. Appropriate scriptures, sacred or profane, may be easily selected and represented in endless variety of forms and ornamentations.

THE MANUFACTURING DEPARTMENT OF THE PROVINCIAL EXHIBITION.

There are many circumstances connected with the Arts and Manufacturing Department of the Provincial Exhibition, which call for serious attention. We look in vain through these annual expositions of our industry, for a representation of that progress in our manufactures which might have been expected, and which we know to have taken place at London. It is not difficult to account for the absence of many names among the exhibitors, who, if the Exhibition had been held at Hamilton, Toronto, or Kingston, would have been well represented. Manufacturers do not like to send their best specimens to a considerable distance, subjecting them to the three-fold risk of injury by railway carriage to

and fro, handling at the Exhibition building, and risk of damage from unavoidable exposure to the crush of many thousand spectators, who have to see all they can during two days.

There is another objection felt by many who are otherwise much interested in our annual displays, and who would do all in their power to assist by contributing articles for exhibition. It is the sheer impossibility of having justice meted out to all, by those who are employed as judges. There can be no doubt that the gentlemen who have officiated from time to time, have uniformily acted according to the best of their ability, based upon the opportunities which have been given them for forming a correct judgment of the merits of each competitor. But how is it possible that in the space of a few hours any men, however intelligent and conversant with their subject, can deal with many hundred articles submitted to their inspection. Very frequently they require information which cannot be immediately procured, and yet they are required to make their awards as if they knew all the circumstances of the case. In a Canadian Exhibition, if two articles are offered for competition possessing apparently equal merits, the decision of the judges would rest upon other considerations than those which meet the eye—if one article were wholly Canadian in its construction down to the nails or hinges, but the other embraced some parts which bore the stamp of foreign manufacture, it is clear that that which was a home production in all its parts, has a claim beyond the other taking advantage of foreign aid.

In order that prizes may be adjudged to those most deserving, and in strict accordance with the objects of the Provincial Exhibition, more time must be placed at the disposal of the judges. Again, very may articles are entered for competition which, although not obtaining a prize, are certainly deserving of public notice, but there is not time enough to draw up such a report as would embrace the merits of nine-tenths of the articles shown ; and, as already stated, the necessary information is often sought for in vain during the day appointed for the awards to be made, and when obtained it is frequently too late, and the competitor retires in disgust.

Another objection to the present arrangement of our Annual Exhibitions, as far as the Arts and Manufacturing department is concerned, is the short period of time allowed for inspection, and the exceedingly unfavourable circumstances under which an inspection has to be made. Many hundreds go to visit our Annual Exhibitions for the express purpose of examining the Arts and Manufactures department, and they would willingly devote several hours to a quiet study of what ought to be a representation of the industry of the country. Exhibitors generally sent their contributions to be seen by the public, their object is to make themselves known by their works, with a view to ultimate pecuniary benefit. They look upon the Exhibition as an advertisement on a large scale, and one which affords them an opportunity for displaying in public what they are prepared to execute in private. The end they have in view cannot be answered by three days of partial exhibition, brief notices in the public press, and frequently no notice at all from those who are appointed to decide upon their merits.

The remedy is simple enough. The Exhibition of Arts and Manufactures should extend over a longer time, and be open at least one week before the Agricultural Department begins. Ample time should be allowed for careful arrangement of the articles contributed, and at least three instead of one day given to the judges to report on the articles exhibited, not those only which are considered worthy of prizes, but those which are deserving of being brought before the public. Every effort should be made to serve the object the exhibitors have in view, and a few lines, embracing a single paragaph, will often prevent dissatisfaction at supposed neglect, and be a just tribute to energy and skill, with which the public ought to be familiar.

There are now four permanent Exhibition Buildings in Upper Canada ; at Toronto, Hamilton, London, and Kingston. At each of these buildings there is, or at small expense might be, room for the display of many specimens of industry and art, which we cannot expect contributors to send far at considerable risk, to be exhibited for two or three days to many thousand persons at once, who necessarily hurry through the building in hot haste, to catch a glimpse of as much as they can in the short time allowed them. Let the Arts and Manufactures department be opened for actual inspection for one week before the articles belonging to the Agricultural department arrive, and there will be no lack of contributions or interest in the display. Next year the Exhibition is to be held at Toronto, and the opportunities for trying the experiment are the best that could be offered in Upper Canada. The building is large and commodious, and situated in the centre of our manufacturing industry. The trial is worth making, and we trust those suggestions will receive attention from these who are influential in arranging the details of the next Provincial Exhibition.

ON THE MEDICINAL PROPERTIES AND USES OF OUR NATIVE MEDICINAL PLANTS.

BY WILLIAM SAUNDERS, LONDON, C. W.

To treat separately of the properties of each of the remedies in the above list would occupy a space by far too great, and exceed the object of the present paper, which is merely to introduce the subject

to public attention; still there are some among them of such relative importance as to demand a separate notice. Of these we shall speak first, and sum the others up in classes according to their action on the animal economy. That the general reader may more readily comprehend the objects spoken of we shall use their common in preference to their scientific or botanical names.

Among the most valuable and generally known, both commercially and medicinally, of our native remedies are, Bloodroot, Wild Cherry Bark, Dandelion, Lobelia, Mandrake, Seneca Snake Root, Slippery Elm Bark, Stramonium, Golden Seal, and Black Cohosh. The two last, although well known natives, are not in the list of those exhibited, which for want of time was necessarily very incomplete.

Bloodroot (*Sanguinaria Canadensis*).—This interesting plant is common almost everywhere throughout the Province, growing in loose rich soils and shady situations. It is among our earliest spring flowers, and may be easily recognized by its beautiful peltate leaf and delicate white flower. The root is the only part used in medicine. It is a powerful and valuable remedy, acting in small doses as a stimulant and expectorant, in over doses producing nausea and vomiting. It enters into the composition of many popular cough mixtures, and has been highly extolled by some practitioners as an alterative in torpid conditions of the liver.

Wild Cherry Bark (*Prunus Virgineana*).—The inner bark is the part used, and is strongest when gathered late in the fall. Its taste is agreeably bitter and aromatic, with the peculiar flavor of bitter almonds. This bark unites with a tonic and stimulant a decided sedative influence, and is therefore a valuable agent in cases of debility attended with nervous irritation. In the form of pastile it is used to allay tickling coughs; it is also prescribed as a palliative in the hectic fever of consumption, and as an additional proof of its value, it is a leading ingredient in the most popular patent medicine of the day for coughs and colds, I mean Cherry Pectoral. It is best administered in the form of fluid extract.

Dandelion (*Leotodon dens Leonis*).—This well known plant is found in almost every part of the globe. It is abundant in this country, adorning our fields with its bright yellow flowers from the opening of spring to near the close of summer. The root is the officinal part, and is largely used both in this country and on the continent of Europe in liver complaints and in disordered states of the digestive apparatus. It is generally prescribed in the form of extract, which is best made by evaporating the juice of the fresh root to a pilular consistence.

Lobelia (*Lobelia inflata*).—This powerful remedy was a favorite with the medicine man among the Indians long before the settlement of this country by the whites. It is a well known weed, and is found in abundance in fields, meadows, and woods, in almost every part of Canada. Both the plant and the seeds are used in medicine. They are emetic, and in small doses expectorant and diaphoretic. As an emetic it is a popular remedy in domestic practice in many parts of the country, and in moderate doses is usually safe and prompt in its action. It has been found valuable in croup, and is frequently used in combination with bloodroot and squills for coughs and colds. The plant smoked has proved very useful in spasmodic asthma, the paroxysms of which it often greatly mitigates and sometimes wholly relieves. An oil is prepared from the seeds which is very powerful, and is used both internally and externally.

Mandrake (*Podophyllum Peltatum*).—This plant grows abundantly with us in rich woods and fields, sometimes covering acres of ground with its large palmate leaves. The mandrake was well known to the Indians, and much used by them as a purgative. The root is the only officinal part, and the proper time for collecting it is in the latter end of October, when it will be found full and plump. It is an active and certain cathartic, somewhat resembling jalap in its mode of operation. A resinoid, called *Podophyllin*, is prepared from the root, which contains all its properties in a concentrated form. This is extensively used by all classes of practitioners, and as an aperient and alterative medicine it takes with the eclectic physician the place of mercurials.

Seneca Snake Root (*Polygala Senegæ*).—This plant is more abundant in the southern and western parts of the United States than with us, yet it may be gathered in considerable quantities in Canada in some localities, growing in open rocky or sandy woods and plains. The root only is used. It acts as a powerful stimulant on most of the secretions, and is much valued as an expectorant in combination with squills in coughs and colds. It has proved serviceable in chronic catarah, protracted cases of inflammation of the lungs, and in the secondary stages of croup. It is not indicated where acute inflammation exists.

Slippery Elm Bark (*Ulmus fulva*).—The inner bark is the part used. It is a valuable demulcent and emmollient, and in the form of infusion has been found highly beneficial in inflammation of the mucous membrane of the stomach and bowels. It is a deservedly popular remedy in coughs and sore throat, and in the form of a coarse powder is much used externally for poultices.

Stramonium (*Datura Stramonium*).—This plant, known also by the name of Thornapple, is abundant in all sections of this country. It is large and succulent, and may be easily recognized when full grown by its remarkable seed-vessel, which is thickly covered with sharp thorns. All parts of the plant are medicinal. It is a powerful narcotic, poisonous in large doses. It has been used with success in epilepsy, also in neuralgic and rheumatic affections, and the leaves smoked have acquired considerable reputation in asthma. The seeds are the most powerful.

Golden Seal (*Hydrastis Canadensis*).—This is a small plant with a simple erect stem, growing from six to ten inches high, bearing two unequal terminal leaves and a simple small white or rose colored flower. It is found plentifully in many parts of the country, growing in rich soil in shady woods and damp meadows. The root only is officinal. It is of a beautiful yellow color internally, and is used by the Indians as a dye. It is a powerful tonic, useful in dyspepsia, chronic diarrhæa, and in all other cases where tonics are indicated. As an external application it has been used and recommended in cancer, both here and in Britain, also in various forms of opthalmic disease.

Black Cohosh (*Cimicifuga Racemosa*).—This root is a very popular medicine among physicians of the eclectic school, and is used for a great many different complaints. Among its other properties it is stated to be narcotic, tonic, and anti-periodic. It has lately been introduced to the medical profession in Great Britain by Professor Simpson of Edinburgh, who recommends it very strongly in acute rheumatism, and it is now largely used with, it is said, remarkable success.

As alteratives used for purifying the blood we have, in addition to those already spoken of, a number of valuable roots, as Yellow Dock, Burdock, American Sarsaparilla, Spikenard and Yellow Par. illa. These have all been extensively used, and are very highly spoken of by many. Yellow Dock and Burdock are especially working their way into general use, and probably will eventually supersede in scrofulous and other complaints of a similar character some of the more expensive imported drugs. Of the Burdock both seeds and root are used, and are found to possess similar properties. The American sarsaparilla is preferred by many to the imported; it can be afforded at a much lower price, and may at all times be procured fresh. There is in addition to this a long list of alteratives, whose properties have not been fully investigated, but which probably comprises some valuable agents; these are, Blue Flag, American Ivy, Elder Flowers, Sassafras, White Pine Bark, Prince's Pine, Poke Root and Tamarac Bark.

As astringents, valuable in diarrhœa, dysentery, &c., there are several well known remedies, such as Blackberry Root, Cranesbill, White Oak Bark, Raspberry Leaves, and besides these some others whose virtues are not so generally known. Beth Root, Beech Drops, the roots of the Yellow and White Pond Lilies, Liverwort Leaves, Nettle Root, Wintergreen Leaves, and the bark and leaves of the Witch Hazel.

Our list includes a considerable number of tonic medicines. The Poplar, White Ash, and Prickly Ash Barks, which, together with the buds of the Balm of Gilead, have been used with success in intermittent fevers. Balmony, a valuable remedy for dyspepsia. Bitter Root, which unites diaphoretic and emetic to its tonic properties. Swamp Dogwood, American Gentian, Black Willow Bark, Ginseng, Goldthread (which is also used as a topical application in the sore mouth of infants), Solomon's Seal, Sweet Flag, May-weed, Maiden-hair, Spicewood Twigs, and Vervain Root.

As expectorants for coughs and colds we have, in addition to those spoken of in the former part of this paper, Horehound, Elecampane, and Sweet Cicely; and as carminatives, the virtues of which in the flatulent colic of infants almost every mother is familiar with, there are Peppermint, Catnip, and Spearmint.

Of laxatives, besides the Mandrake already mentioned there are several. Butternut Bark, which is a mild but valuable remedy in habitual constipation, Wild Celandine, Garden Celandine, and White Cohosh. The two last of these are drastic and too powerful for general use.

The value of diaphoretic medicines in many complaints is well known, of these our list is not bare. It includes Boneset, Wild Ginger, Cocash, Blue Lobelia, Saffron, White Snake Root, and Pleurisy Root, the last unites expectorant with its diaphoretic properties.

Of Anthelmintics we have Wormwood and White Indian Hemp; these, although not so agreeable to the taste as the worm candies so popular, are doubtless valuable remedies in some cases. As diuretics there are Cleavers Yarrow, Queen of the Meadow, both root and leaves, Partridge Berry Vine, Horse Radish Root and Stone Root. As antispasmodics the most valuable are Scull-cap, Ladies' Slipper Root, Skunk Cabbage Root, and Cramp-bark. As a narcotic we have Poison Hemlock, which in the form of extract is extensively used; and as emenagogues Pennyroyal, Tansy, Blue Cohosh, Milkweed Root, Motherwort, and Water-pepper. Of demulcents we have two, Comfrey, which is also slightly astringent and the common Mullein, which is likewise used externally in the form of poultice.

London, Oct. 18, 1861.

Canadian Medicinal Plants.

List of Medical Herbs, Roots, &c., all of native growth, exhibited by William Saunders, London, at the Provincial Exhibition, 1861.

Achillea Millefolium (*Yarrow*).
Marrubium Vulgare (*Hoarhound*).
Datura Stramonium (*Stramonium Leaves*).
Artemisia Absinthium (*Wormwood*).
Eupatorium Perfoliatum (*Boneset*).
Gaultheria Procumbens (*Wintergreen*).
Salvia Officinalis (*Sage*).
Adiantum Pedatum (*Maiden Hair*).
Hepatica Americana (*Liverwort*).
Verbascum Thapsus (*Mullein*).
Anthemis Cotula (*Mayweed*).
Leonurus Cardiaca (*Motherwort*).
Galium Aparine (*Cleavers*).
Polygonum Punctatum (*Water Pepper*).
Tanacetum Vulgare (*Tansy*).
Mentha Viridis (*Spearmint*).
Mitchella Repens (*Partridge Berry Vine*).
Rubus Strigosus (*Raspberry Leaves*).
Lobelia Inflata (*Lobelia*).
Mentha Piperita (*Peppermint*).
Eupatorium Purpureum (*Queen of the Meadow Leaves*).
Nepeta Cataria (*Catnip*).
Conium Maculatum (*Poison Hemlock*).
Hamamelis Virginica (*Witch Hazel Leaves*).
Scutellaria Lateriflora (*Scullcap*).
Lobelia Syphillitica (*Blue Lobelia*).
Chimaphila Umbellata (*Prince's Pine*).
Impatiens Pallida (*Wild Celandine*).
Panax Quinquefolium (*Ginseng*)
Asclepias Cornuti (*Milk Weed Root*).
Asclepias Incarnata (*White Indian Hemp*).
Coptis Trifolia (*Gold Thread*).
Asarum Canadense (*Wild Ginger*).
Iris Versicolor (*Blue Flag*).
Podophyllum Peltatum (*Mandrake Root*).
Symphytum Officinale (*Comfrey*).
Convallaria Multiflora (*Solomon's Seal*).
Taraxacum Dens Leonis (*Dandelion Root*).
Verbena Hastata (*Vervain Root*).
Apocynum Androscæmifolium (*Bitter Root*).
Eupatorium Aromaticum (*White Snake Root*).
Sanguinaria Canadensis (*Bloodroot*).
Polygala Senegæ (*Seneca Snake Root*).
Arum Triphyllum (*Indian Turnip*).
Collinsonia Canadensis (*Stone Root*).
Caulophyllum Thalictroides (*Blue Cohosh*).
Datura Stramonium (*Stramonium Root*).
Osmorrhiza Longistylis (*Sweet Cicely*).
Menispermum Canadense (*Yellow Parilla*).
Asclepias Tuberosa (*Pleurisy Root*).
Nymphœa Odorata (*White Pond Lily*).
Aster Puniceus (*Cocash Root*).
Rumex Crispus (*Yellow Dock*).
Rubus Villosus (*Blackberry Root*).
Geranium Maculatum (*Cranesbill*).
Aralia Nudicaulis (*American Sarsaparilla*).
Cypripedium Pubescens (*Ladies Slipper*.
Arctium Lappa (*Burdock Root*).
Cochlearia Armoracia (*Horse Radish Root*.
Phytolacca Decandra (*Poke Root*).
Gentiana Catesbei (*American Gentian*).
Symplocarpus Fœtidus (*Skunk Cabbage Root.*)
Urtica Dioica (*Nettle Root*.)
Acorus Calamus (*Sweet Flag Root*).
Eupatorium Purpureum (*Queen of the Meadow Root*).
Aralia Racemosa (*Spikenard*).
Inula Helenium (*Elecampane*)
Nuphar Advena (*Yellow Pond Lily*).
Dirca Palustris (*Leatherwood Bark*).
Quercus Alba (*White Oak Bark*).
Salix Nigra (*Black Willow Bark*).
Viburnum Opulus (*Cramp Bark*).
Prunus Virginiana (*Wild Cherry Bark*).
Fraxinus Acuminata (*White Ash Bark*).
Juglans Cinerea (*Butternut Bark*).
Hamamelis Virginica (*Witch Hazel Bark*).
Xanthoxylum Fraxineum (*Prickly Ash Bark*).
Larix Americana (*Tamarac Bark*).
Cornus Sericea (*Swamp Dogwood Bark*).
Populus Tremuloides (*Poplar Bark*).
Pinus Strobus (*White Pine Bark*).
Ulmus Fulva (*Slippery Elm Bark*).
Populus Balsamifera (*Balm Gilead Buds*).
Orobanche Virginiana (*Beech Drops*).
Ampelopsis Quinquefolia (*American Ivy Twigs*).
Humulus Lupulus (*Hops*).
Carthamus Tinctorius (*American Saffron*).
Sambucus Canadensis (*Elder Flowers*).
Xanthoxylum Fraxineum (*Prickly Ash Berries*).
Chelone Glabra (*Balmony*).

NEW APPLICATION OF ROCK OIL.

Rock Oil is now so abundantly procured in Western Canada, that its price has been reduced to six cents a gallon at the Railway Station near the wells. Refined oil can be procured for fifty cents a gallon, and will yet be cheaper when the best modes of refining are adopted. Rock oil or Petroleum can be used for carbonizing common illuminating gas, and a saving of from twenty to twenty-five per cent. be effected. The Commissioners of Sewers of the city of London have had the matter investigated, and the report of the gentleman they employed contains the following paragraphs

The patentees stating that, by the application of their process, equal light would be given with half the ordinary consumption of gas, the burners were regulated accordingly.

The lamps experimented upon were twelve in number—six upon the western side, which were fitted with the ordinary batswing burners, calculated to consume, upon the average of the night, 5 cubic feet of gas per hour; and six upon the eastern side, fitted with batswing burners, calculated to consume $2\frac{1}{2}$ cubic feet per hour; the latter burners having attached to them the carburating apparatus of the company. Each of the twelve burners had a metre attached to it, to ascertain the actual consumption. No pressure regulators were fixed upon the lamps.

The registration commenced on the 10th of June, and terminated on the 19th of July inst.—the experiment extending, therefore, over thirty nights—and gave the following results:—That the burners without the carburating apparatus consumed about 4.30 cubic feet per hour. That the burners fitted up with the carburating apparatus consumed 2.09 cubic feet per hour.

No photometer was employed; the equalization of the amount of light given by the two classes of burners, was a matter of judgment. The district inspector of the commission, who saw the light nightly, reports his opinion that the light given was perfectly equal, and his opinion is strengthened by collecting those of certain residents in the neigh-

bourhood. My own opinion is that the light of the 2½-feet burners was, upon the average of the month, inferior, although but very slightly so, to that of the five feet burners. The inspector of the Chartered Company coincides with me in this. No chemical analysis was made of the naptha used, but it is stated by the patentees to have been of the best quality.

My deduction from the experiment is, that with naphtha of equal quality to that used during the warm months of the year, 3 cubic feet of carburated gas may be considered as about equal to 5 cubic feet of gas not carburated.

Assuming this to be data applicable to all seasons of the year, I have estimated the saving to be effected by the process; and, after allowing for the cost of the apparatus, and for periodically filling it with naphtha, and after giving credit, at the present price of the gas supplied to the public lamps, for the quantity not consumed, it shows that the reduction in the cost of each public lamp will be at least 20s. per annum; and, there being 2,825 lamps within the city, that a saving of about £2,825 would be annually effected.

The only disadvantage observed during the experiment was, that the reservoir, as constructed, throws a disk of shadow round the base of the gas-lamp standard; but the depth of shadow is but slight. This disadvantage may be largely rectified by an alteration in the form of apparatus.

It should be understood that I do not pledge myself to any of these figures as exact, for the experiment, as conducted, cannot lay claim to be considered minute or exact in its character; but I believe it may, nevertheless, be taken as giving a close approximation to the truth. It is the mean of the rough results of practice, and the refined processes of the laboratory, from which reliable data are generally drawn. In this case the results of the experiment are supported by laboratory experiments, and, consequently, there seems but little doubt that this mode of applying naphtha to the public lights (for the naphthaization of gas itself is by no means new) may lead to a considerable reduction in the cost of public lighting; but what that reduction ultimately would be, would depend upon points which can only be determined by the application of the process to a considerable number of lamps for some length of time, and at different seasons.

It is important to remind Refiners of Petroleum or Rock Oil, that by pushing the process too far they will obtain an explosive oil, a hydro carbon, having a specific gravity less than 0·800, for all mineral oils with a specific gravity of 0·785 are dangerous, and very many of them highly explosive, so that a light held over them would instantly inflame the whole mass. It is necessary to observe this caution in time, for if any accident should occur from the use of Rock Oil of too low a specific gravity, the general interests of the Refiners would be materially changed. An insurance company would not effect the insurance of buildings where highly refined Rock Oil was used, that is to say, Rock Oil having, so to speak, an explosive specific gravity. Shocking accidents have already occurred in England from the explosion of similar oils.

The carbonizing of the gas of Toronto ought to engage the attention of consumers. In conjunction with the direct manufacture of gas from Rock Oil, a new use will be found for this material.

The Board of Arts and Manufactures

FOR UPPER CANADA.

PROCEEDINGS OF THE BOARD.

The Sub-Committee met at the Board Rooms, Mechanics' Institute, Toronto, on Thursday, October 31st. Present: The President, Vice-President, Professor Hincks, Professor Hind, W. Hay, Dr. Craigie, and T. Sheldrick.

After reading of minutes of former meeting, a letter was read from the Bureau of Agriculture, informing the Committee that arrangements will be made for publishing a monthly list of Letters Patent issued in Canada. Other miscellaneous correspondence was read, and various accounts passed for payment, when the President reported that the Government had appointed as Commissioners for Canada to the International Exhibition of 1862, Sir Wm. Logan, Dr. Tache, the Presidents of the Boards of Agriculture for Upper and Lower Canada, himself as President of the Board of Arts and Manufactures for Upper Canada, and B. Chamberlin, Esq., Secretary (the President having declined to accept the appointment) of the Board of Arts and Manufactures for Lower Canada.

The Commissioners, on their appointment, had at once held a meeting in Montreal, and waited upon the Hon. the Finance Minister in regard to the funds necessary to conduct the Commission. A memorial had also been forwarded to the Government at Quebec, for an appropriation of money for the purpose, to which the Commission is waiting a reply.

Resolved, That the expenses of the President, as Representative of the Board of Arts and Manufactures on the Commission appointed by the Government in connection with the International Exhibition at London, be paid by this Board; subject to the understanding, that in case the Government makes an appropriation, such amount expended be refunded.

The subject of the continuation of the Journal of the Board for the ensuing year, and the form in which it is most desirable to issue it, were discussed, when it was

Resolved, That the monthly issue be continued, on the same terms as during the present year, but with the following improvement: that the *Journal* be stitched and cut, and put in colored covers containing the advertisements, leaving thirty-two clear pages of reading matter in each number.

The Secretary was instructed to correspond with the Secretary of the Board of Arts and Manufactures for Lower Canada on the subject of making the *Journal* a joint publication for the two Boards.

The subject of appointing an Agent to canvass the Upper Province for subscriptions, advertisements, and information, for the *Journal* was discussed, when it was

Resolved, That a Travelling Agent be appointed, for the purpose of obtaining subscribers and advertisements for the *Journal*, and to advocate the interests of the Board, &c.

Resolved, That the President furnish such Agent with a general letter of introduction, defining his relation to the Board; that he visit such localities in Upper Canada as are likely to be interested in the objects of the Board of Arts and Manufactures, and the *Journal;* canvass Mechanics' Institutes, manufacturers and others for subscriptions and advertisements for the *Journal;* and that he endeavour to procure for the purposes of the *Journal* information relative to manufactures, and specimens of manufactures for the Museum, throughout the Province."

The Secretary reported a donation of thirty volumes of Reports of Commissioner of Patents for the United States, embracing the years 1850 to 1860.

Resolved, That the Secretary be instructed to acknowledge the receipt of thirty volumes of Reports from the Hon. the Commissioner of Patents for the United States, with the thanks of the Board therefor.

After transaction of some other routine business, the meeting adjourned.

W. Edwards,
Secretary.

BOOKS ADDED TO THE FREE LIBRARY OF REFERENCE DURING THE PAST MONTH.

CLASS V.

Catlaogue of officers and students of Harvard University.. 1861–62.

CLASS XVIII.

Report of Commissioners	of Patents for the U. S.,	Mechanical,	with Drawings	& Illustrations	1	vol.	1850.
"	"	Agricultural,	"	"	1	"	"
"	"	Mechanical,	"	"	1	"	1851.
"	"	Agricultural,	"	"	1	"	"
"	"	Mechanical,	"	"	1	"	1852.
"	"	Agricultural,	"	"	1	"	"
"	"	Mechanical,	"	"	1	"	1853.
"	"	Agricultural,	"	"	1	"	"
"	"	Mechanical,	"	"	2	"	1854.
"	"	Agricultural,	"	"	1	"	"
"	"	Mechanical,	"	"	2	"	1855.
"	"	Agricultural,	"	"	1	"	"
"	"	Mechanical,	"	"	3	"	1856.
"	"	Agricultural,	"	"	1	"	"
"	"	Mechanical,	"	"	3	"	1857.
"	"	Agricultural,	"	"	1	"	"
"	"	Mechanical,	"	"	3	"	1858.
"	"	Mechanical,	"	"	2	"	1859.
"	"	Agricultural,	"	"	1	"	"
"	"	Agricultural,	"	"	1	"	1850.

CLASS XX.

Phonetic Journal; Monthly.. *London.*

NOTICES OF BOOKS.

Annals of the Botanical Society of Canada. Vol. 1., Parts I. and II.: from 7th December, 1860, *to* 8*th March,* 1861.

Science in Canada is beginning to be well represented by Societies devoted to the encouragement of its different branches. First in the field was the Literary and Historical Society of Quebec, founded under the patronage of the Earl of Dalhousie, in 1824. Several volumes of the Transactions of the Society have already appeared, and good service would be done to the public if a more liberal distribution of the documents were made, and others printed and published which are understood to be still in the MS. of the archives of the Society.

The Natural History Society of Montreal publish a bi-monthly journal, well and favorably known by the name of the Canadian Naturalist and Geologist. This publication is yearly increasing in interest, importance, and we hope, in a wide-spread circulation. The Canadian Institute of Toronto have for many years published the Canadian Journal of Industry, Science, and Art. This ably conducted periodical is well known throughout America and in England. In conjunction with its sister publication, the *Canadian Naturalist and Geologist*, it is accomplishing a most excellent purpose in diffusing a knowledge and taste for Natural Science in Canada, besides serving as the medium through which the Natural History, Geology, and Meteorology of Canada is presented in an acceptable form to men of science in Europe. Lastly, we have the published records of the youngest Society in Canada devoted to Science, under the form of the Annals of the Botanical Society of Canada.

From the names of those who appear as contributors we have no doubt that it will rapidly win favour and esteem among the students of Botanical Science. Two parts have already appeared in *quarto* form, an obsolete

mode of publication, and one which, we venture to predict, will soon be changed to the more acceptable and convenient octavo form. The subjoined table of contents will shew the character of this new and deserving claimant to the best wishes of the friends of scientific progress on this continent.

TAYLOR'S IMPROVED DOOR BELL.

Fig. 1.

Fig. 2.

Taylor's door-bell has several advantages over the usual bells and door-knockers; it is as easily applied as a knocker, and as a bell it cannot be surpassed. Tenants on removing can take the bell with them

as they would their name-plate; it can be applied to doors of from 1 inch to 2½ inches in thickness without alteration, in five minutes. It is also an excellent call-bell for hotels and offices, and needs only to be seen, to be appreciated by all. It was awarded the highest premium at the Provincial Exhibition, held in London, September 1861; also, a diploma at the Union Exhibition, held in Toronto, in October 1861. The inventor of this door-bell is Mr. E. A. Taylor, of Hillside, Brockville.

Fig. 2 is the handle or crank placed upon the outside of the door, usually where a knocker would be placed. Fig. 1, a bell, saucer-shape, reversed, placed upon the inside of the door, immediately opposite the handle, (fig. 2). With one revolution of the handle (in either direction) the bell (fig. 1,) is struck three times. The mechanism of this invention is extremely simple in its construction, not liable to get out of order (with ordinary use) in *many years.* The bell being reversed, covers the mechanism, and therefore cannot receive any injury, either intentional or otherwise. This improved bell is designed to supersede the door-knockers, and in most cases the usual door-bells which are rung by pulls and wires, and require an expert to hang them, and when hung, are often expensive to keep in repair.

The Board of Arts & Manufactures

FOR LOWER CANADA.

ANNUAL COURSE OF FREE LECTURES.

"THE HISTORY AND LAW OF LETTERS PATENT OF INVENTIONS,"

BY DUNBAR BROWNE, M.A., B.C.L.

(*Continued from page* 266.)

A summary of these provisions will not, I trust, be wearisome or ill-timed:—

Any British subject, residing in Canada, may obtain a patent for the exclusive property of any new and useful invention made by him, for 14 years, such patent not to be void because the whole or any part thereof might have been previously known in some foreign country, unless the same had been patented and described in some printed publication. But an original and true inventor is not to be deprived of his patent right because he may have taken out Letters Patent for the same in a foreign country within six months of or preceding his application for such patent.

A patent may be assigned or granted to an assignee, but the application must be made by the inventor.

The specification and drawings must be in duplicate, one to be deposited in the office of the Agricultural Bureau in connection with which the patent business is transacted, and the other to be annexed to the patent.

When a patent becomes inoperative from inadvertency, accident or mistake, and not through fraudulent or deceptive invention, a new patent may be issued for the residue of the term, the original patent being surrendered. When a patentee has made his claim too broad he may disclaim any part of the invention not really his own, such disclaimer to be considered part of the original patent.

Additions may be made to patented inventions, which will be subjected to revision and restriction as original applications.

Patents may be extended for seven years beyond the original term, on the report of a Board, consisting of the President of the Executive Council, the Attorney General for the part of the Province where the applicant resides, and the Inspector General, if it appear to them that the inventor has not derived from his invention, during the term of the patent, sufficient remuneration. The application or notice of it must be made six calendar months previous to the expiration of the first patent. Persons other than the inventor having purchased, discovered or manufactured machines or other inventions prior to the application for a patent therefor, may use the same, without invalidating the patent.

Works of art and designs may be patented for 14 years. I may here remark that previous to the passing of the Consolidated Statutes, this class of patent was only granted for seven years.

Patented articles to be stamped with the date of the patent under penalty of forfeiture, and parties stamping unpatented articles as patented to be liable to fine and imprisonment or both.

The right of patent in Canada does not extend to any invention made in the United States or in any part of British America.

A model must accompany the application, or specimens of the ingredients in case of a composition, and the application and specification must be examined by one of the Attorneys or Solicitors General before the patent can be granted.

Where interferences in applications occur, three experts are to adjudicate upon the matter, one to be chosen by each of the applicants, and the third by the head of the department.

Travellers may import and patent inventions learned by them in their travels, provided such importation be not from the United States or any part of the British dominions.

The fee for a patent is $20, payable at the time of making the application.

Under these two acts, now consolidated, there have been 909 patents granted, making in all 1,199 from the institution of patent laws in this Province to the present day.

Having thus briefly brought before you the history of Letters Patent, and at the same time furnished you with an epitome of the laws which were and are in force on this subject, I now turn to the second part of my subject—the law and practise of patents as now existing in this Province.

We have seen that a patent is not a thing to be claimed of right, but that it is a grant made upon certain conditions introduced into the patent itself, the subject of which is to secure to the public the full enjoyment of such inventions as they may be possessed of, and that at the expiration of the period for which the patent is granted, the invention shall become public property—to secure which end a description and specification describing the construction and manner of working the invention is attached to the patent, so that any mechanic understanding the branch of industry of which it forms a part may, without difficulty, construct and make the same.

Whenever any one succeeds in producing a new invention, he generally asks whether he cannot procure a patent for it, and thereby secure to himself the benefits to be derived from the fruits of his own labor, research and experiment. For the benefit of such I shall endeavor to explain the general requirements and principles of the law, and while avoiding the usual legal technicalities, to lay before you, as briefly as is consistent with the importance of the subject, the law and practice of patents, so that the inventor may be assisted and guided, until such time as having completed his invention he shall place it in the hands of a competent solicitor to prosecute to final sealing.

Among the chief requisites in an applicant for Letters Patent of Invention are—first, that he is a British subject and a resident of this Province; second, that his invention was not known or used here by others before his invention; and, third, that it is not at the time of his application in public view or for sale with his consent or allowance.

Every application consists of a petition to the Governor General, a specification and description and drawings, and a solemn declaration made before a justice of the peace, that the applicant verily believes he is the true inventor of the article or whatever it may be for which he solicits a patent.

The specification and description of the invention must describe, in plain terms, the manner of constructing and the mode of operating it. It must also contain a distinct explanation of the inventor's claim, and a disclaimer of such portion as is not his own invention. Drawings must accompany the specification with written references to correspond to those in the latter. The specification and drawings must be prepared with the greatest accuracy, and must in all cases be in duplicate.

The solemn declaration is substituted for the oath formerly required, and a false declaration is declared to be perjury.

These formalities complied with, the application is ready for presentation, and is sent to the Secretary of the Bureau of Agriculture. It is next sent to the office of the Attorney General for that section of the Province in which the inventor resides, and if the papers submitted are in the form required by the statute, and if the law officer of the Crown who has examined them consider the invention a fit subject for Letters Patent, a fiat or warrant is issued to grant the patent, which in its turn is examined, recorded and delivered to the patentee. Armed with a roll of parchment bearing the signature of the Governor General, and those of the officers of the Executive Council, the inventor becomes inflated with the idea that he has thus received from the Government of Canada an acknowledgment of the validity of his claim, an idea the fallacy of which he only realizes, perhaps, when after having become involved in a series of vexatious lawsuits, he learns that his roll of parchment, instead of being an acknowledgment of the validity of his claim, is worse than worthless, having been instrumental in robbing him of his little stock gathered from the hard-earned proceeds of his labor by the sweat of his brow. 'Tis only then, perhaps, he learns, for the first time, that his invention was known and used here before his discovery of it. This is due to the defective state of the law and to that alone. The Board of Arts and Manufactures for Lower Canada, convinced of the defective state of our law upon this subject, has prepared for submission to Parliament, during its present session, a bill to repeal the enactments now in force, and substituting others collated from the Patent Laws of the different countries of Europe and those of the United States, and which will put us in this respect on a par with the mother country. In reviewing this bill, for the *Scientific American*, Judge Mason, formerly Commissioner of the United States, writes:—"It will, with a few secondary alterations, be a model law, and one worthy the imitation of every nation of Christendom."

It will be seen that the preparation of an application for a patent must be made with great care as to the legality of the form, and with a due avoidance of anything which might afterwards tend to invalidate the patent.

This brings us to consider what is the inducement which leads the Crown to grant Letters Patent. It is the representation of the applicant that he is the first and sole inventor, and the Crown, yielding to such representation and desiring to afford every encouragement to the votaries of those handmaidens of science, arts and invention, concedes to the

inventor the sole right of making and using his invention for a given period, subject to certain given restrictions. It follows, therefore, that if the matter or thing claimed by the patentee is not his invention, the grant is null, inasmuch as the consideration on which it was given fails, and this even where the patentee has invented some other thing for which he might have obtained a valid patent, had a fair representation of such real invention been made. In other words, if the patent represents the grantee to be the inventor of that which was really not his own invention, it is invalid.

Patents are obtained for new manufactures, or for the introduction of a new article from a foreign country.

The best definition of what a patent is granted for, is to be found in the Austrian law, and is as follows:—

A new product of industry; or, a new means of production; or, a new method of production.

The term manufacture, used in regard to inventions, is one whose meaning has been the subject of much discussion, but the repeated interpretations of this broad term by many eminent judges, who have adorned the English bench, have accurately defined it. Lord Kenyon said, "a manufacture was something made by the hands of man." Lord Tenterdon considered it denoted "a thing made which is useful for its own sake, and vendible as such, as a churn, or a medicine, or an engine or instrument to be employed in making some previously known article, or in some other useful purpose, as a steam-engine to raise water, or it might, perhaps, extend also to a new process to be carried on by known implements or elements acting upon some known substances, but producing it in a cheaper or more expeditious manner, or of a better and more useful kind. But no merely philosophical or abstract principle can answer the word manufactures, something of a corporeal and substantial nature, something that can be made by man from the matter subjected to his art and skill, or, at the least, some new mode of employing practically his art and skill, is requisite to satisfy the word." The term manufactures may be construed to mean the machine when completed, or the mode or manner of constructing the machine, and in strictness, it is presumed, it cannot be considered to be the product of mechanical means, and therefore it has no relation to the principle of the construction—the combination of the parts—the method of effecting that combination—of the principle of its action, or the process by which it is effected, and all which have been decided by the Courts of England to be proper subjects for the grant of Letters Patent.

Scientific principles or purely scientific theorems, cannot be patented even if the principle or theorem admit of a direct application to industrial objects, but, nevertheless, I find that in 1845 a patent was granted in Lower Canada to John Maitland, of the City of Toronto, distiller, for the invention of "a new principle of distillation and rectification, by means of a new still condenser and rectifier"—and that in 1848 another was granted to Henry Ruttan, of Cobourg, Esquire, for the invention of "the true philosophical principles upon which buildings may be ventilated; and also of machinery by which the ventilating air may be warmed." This latter patent, however, was afterwards surrendered.

Patents may be obtained for every new application of such principles or theories as lead to the creation of a new industrial product, or produce some new means or a known means in a new way; but it must be observed that it will not do to claim generally the application or manner of applying such principle, but some specific manner of doing it must be detailed; and though one person may discover a particular principle another may apply it to a particular thing, and such application will be a fit subject for the grant of a patent.

Method is a matter very nearly akin to principle, being the placing together of several things and the performance of several operations in the most convenient order. It may also mean a contrivance or device, as may an engine, for method and engine are synonimous terms.

Inventors, therefore, cannot be too careful in the selection of their terms, as a misapplication of them may sometimes vitiate a patent for a really good invention. Thus in looking over the published list of patents I find that a very large proportion of them are alleged to be for new methods, whereas really the inventions does not consist of the method of production so much as it does for the product itself. (Page 155.)

One of the points of greatest importance in the invention is novelty, for that is one of the chief considerations for the grant of a patent. The mere fact of the patentee having been the inventor of the thing patented is not sufficient to sustain a patent, for if it can be proved that the invention was in use, or that a description of it was published in any printed publication previous to the application for a patent, even though the patentee was not aware of such use or publication, and that because the public cannot be excluded from the right of using that information of which they were in possession previous to or at the time of the application for a patent. In a trial affecting a patent when the question of want of novelty was raised, the principal question for the consideration of the jury would be, whether in case of publication it had been such as to make the description a part of the public stock of information.

An inventor possessed of a secret invention who

shall for a period of years retain the monopoly and sell the produce of his invention publicly, cannot afterwards take out a patent for it, since he would thus derive more benefit than could be obtained during the lawful period of fourteen years, a system which, if encouraged, would materially retard the progress of science and art.

In the case of *Bernier* v. *Beauchemin* for infringement of patent right, decided by the Court of Queen's Bench, appeal side, last year, it was decided that a patent granted for an invention applied for after it had been publicly used by the inventor was bad, although there was no proof that the invention was used by others before his discovery of it. This decision therefore sets at rest the question of the right of the inventor under our existing laws to make use of his invention before patenting it, and points out the necessity for affording the inventor a limited protection to fairly test his discovery before incurring the expense of a patent.

Although the publication of a description of an invention prior to the obtaining of a patent would invalidate the grant, yet the existence of a single copy of a work brought from some depository where it had long lain in obscurity, would afford a very different inference than would the production of an encyclopædia or other work in general circulation. In order to secure the vacation or annulling of a patent on the ground of want of novelty, the evidence must be of a direct nature. It will not even suffice that it is of a strong inferential nature, it must be direct and positive. In the case of a simultaneous invention, he is presumed to be the first inventor, and is entitled to the benefits of the invention, who first publishes and presents it to the public under the protection of Letters Patent. Two patents may be granted for the production of the same thing, provided the means of production are different, for though the process is similar the manner of effecting it may be different and does not amount to the vacation of a patent. From this it results that a patent for a machine, each part of which was in use before, but in which the combination of the different parts is new, and a new result is produced, is good, because there is a novelty in the construction. One patent may be taken out for several inventions, provided they relate to one and the same object, as component parts or operative means, but if it afterwards appear that one or any part of the invention is not new this defect will not only invalidate the patent for that particular part but also for the whole of the several inventions ; for if it be proved that there is no novelty in one of the alleged inventions or improvements the consideration of the grants fails equally as though the whole were faulty, and the patentee is not established. So the benefit of the remaining inventions comprised in the Letters Patent; in other words, a patent which is too large is not only void for the excess but is void altogether.

With regard to improvements, an application to be valid must distinctly disclaim all parts of the invention which were in use prior to an application for a patent, for without such a disclaimer the patent would be vitiated in the same way as when the claim is for several articles one of them not being new. When an improvement on a patented article has been made the patentee of such improvement is not at liberty to use the original patent without the permission of the first patentee, and the first patentee cannot use the improvement without the permission of its patentee.

Having thus considered what is understood by novelty in a patent, the next point to be considered is what constitutes publication, and what are the effects of which it may be productive. By publication is meant use in public, so as to become the knowledge of others than the inventor contra distinguished from the use by the latter in his own character, which public use, though not general, will invalidate the patent.

If an invention be made in secret, under injunction, by one party for another, such use will not be construed to be a publication, for the public cannot take any advantage of it, inasmuch as it never was vested in them. And in my opinion this use or publication is not limited to Canada, for if it be proved to have been publicly used elsewhere, the effect is the same. So an exposure for sale, or view, or examination previous to the application for a patent, will vitiate the grant. It will thus be seen that an inventor cannot be too cautious about exhibiting his invention previous to his application for a patent, for though each exhibition may be made to but one person, even if that person assist in completing it, if a disclosure be made by him it will be sufficient to throw open the invention to the public and to invalidate the patent.

We have thus considered what are fit subjects for Letters patent, and the course to be adopted by the inventor who desires to secure a valid patent, we shall now treat of the patent or grant itself.

As soon as an inventor has discovered and com pleted an invention, and satisfied himself of its patentability and validity, the next thing for his consideration is the entitling of it, which, though apparently an unimportant matter, is one of the hinges on which the whole patent hangs. The greatest care must be taken to select such a title as will not cover too much and yet be sufficiently large to embrace all matters which can be legitimately brought within the scope of the invention, not only for the purpose of securing to the discoverer the fruits of his invention, but to prevent infringement

by such imitations as the law would not decree to be merely colourable, whereby the patentee would be deprived not only of the profits of his invention, but the time and money which he may have expended in perfecting the same would be entirely lost. It is therefore suggested that a sound practical title without being too restrictive in its terms would be sufficient to warn the public of the probable object of the invention. Protection against fraud should even be a sufficient reason for construing any particular point or matter of time with strictures ; and perhaps no subject presents such temptations or facilities for fraud as the entitling of patents. Many patents have been vitiated by inappropriate or insufficient titles, which did not give an intelligible idea of the invention. One instance is cited, which is that of a brush called in the title a tapering brush, whereas the invention consisted in the inequality in length of the bristles (*Rese* v. *Metcalfe*, Starkie).

In the case of *The King* v. *Wheeler*, the title described the patent to be a new and improved method of drying malt; when the patent, as appeared by the specification, was for a method of giving to malt when dried a new quality, viz., a power to impart colouring matter, for which misdescription the patent was held to be void on the ground of deceit.

Another title was held as being too general, because the invention being for an improvement in the old street lamp, the title designated it as an improved method of lighting cities, towns and villages. Another was declared void whose title described it as a machine for giving an edge to knives, scissors, &c., because it was not applicable to scissors.

As a title to a patent is a matter of such great importance, it should therefore only be adopted upon the nicest deliberation, and under the advice, in all cases, of competent persons ; for it frequently happens that the very right to the invention depends upon the title selected for it.

The specification need not be in any particular form, so long as it discloses first, the nature of the invention, and secondly, the manner in which it is operated or performed. The expressions should be plain and easy of comprehension, while at the same time the greatest care must be taken that the manner by which the object of the invention is effected shall be accurately stated and in sufficient words, for if there is a want of clearness in the specification so that the public cannot afterwards at the expiration of the patent avail themselves of it, much more if there is any studied ambiguity so as to conceal from the public that of which the patentee is for a time enjoying the exclusive use, the patent itself will be completely void. A specification of improvements must claim the improvements only and not the entire article as improved.

The description must be confined to the invention. No extraneous matter must be introduced to obscure it. It must be minute without perplexity, and luminous without being overwrought.

Mistakes are sometimes innocently made by inventors in this matter, and not with any intention of misleading the public, and in such cases the law comes to their aid and allows them to fyle a disclaimer or renunciation of that part which has been in use or of which a description has been published before the inventor's application for a patent. Such disclaimer, however, cannot have a retroactive effect so as to relieve the patentee from the results of any infringements which have arisen out of the patent previous to the fyling of the disclaimer.

It is a great error to suppose that the introduction of the words "for other useful purposes," "other materials may be used," or "any other substance from which the thing can be obtained," gives greater breadth or security to a patent. Such expressions are not only perfectly useless but may throw doubts on the invention, and hazard the validity on the ground of obscurity and incorrectness. In the case of a patent for paper-making the action was dismissed because the plaintiff in his specification said "the cloth may be made of any *suitable material*, but I *prefer* it to be made of linen warp and woollen weft," whereas he was not aware of any other substance to answer the purpose.

The plural must not be used for the singular or the patent may be invalidated.

The specification and the patent are linked together by the patent, and the title and specification must be read together, and the latter must support the former.

In enforcing a claim the patent and specification are taken as one instrument, and are construed upon the principles of good faith. The description of the invention is of course to be taken from the specification, for its very object is to set out the process by which the invention is to be accomplished.

It is a principle of law that the patentee does not claim things which he knows to be in common use, unless he makes a distinct claim for them in the specification, in which case the presumption would be rebutted by the fact.

The specification is not to be interpreted by persons unskilled in the branch of art of which the invention forms a part, and therefore if it does not mention a particular thing which a workman skilled in the particular manufacture would know to be necessary, such an omission will not void the patent, but if it contains any untrue statement, though the jury find that a competent workman would not be misled by the error, the patent would nevertheless be void.

If words be used in the specification contrary to their usual signification, but if the meaning the patentee had in view can be gathered from the specification, it shall be sufficient.

If a particular process, or manufacture, or machine is described, and the specification is silent as to a particular part, or a combination of parts, it shall be presumed the claim is not for such parts.

The next point for our consideration is to what protection is the patentee entitled, and what is an infringement of a patent right. First, however, of infringement.

The form in which these present themselves are various and must depend upon the nature of the invention. In a process it will be by imitation, in a machine by its manufacture or use, in a vendible article by making and selling. The mere exposure to sale is not a selling, and would be insufficient to satisfy the word vend in the prohibitory part of this patent.

Similarity of structure in the patented article, until the contrary is shewn, would be presumptive evidence, being of the same construction and of the imitation being a piracy.

In the case of a principle, however great may be the improvement introduced, if the adaptation is in the same mode as that suggested by the specification, the difference being the form by which the principle is applied, it will be held to be an infringement for identity of purpose and not of name, is the criterion by which the infringement is to be judged.

When a patent specifies for the use of a particular article, the use of some well known equivalent would be an infringement; but when certain articles are used without intending to infringe the patent, and the party using them does so in ignorance that he is thereby infringing the patent, especially if it is unknown to science that the particular compound would be produced by using the articles which were well known, such use would not constitute an infringement; but after an action, it is presumed, the nature of the articles having been disclosed, there would be a publication to the world, after which the use of the same things would be held to be an infringement of the patent. So also a mere colorable deviation would be an infringement.

Where improvements are claimed, they must also be shewn to be new; an imitation of any part of the invention is sufficient to maintain an action. It need not be shewn that the perfected article imitated in all its parts the original invention; for the substance of the invention and its principle, and not the mere form, are to be looked at.

The sale of a pirated article is sufficient to constitute an infringement.

I have thus briefly considered what is a patent, what are the terms upon which it is granted, and the benefit it confers, as also the liabilities to which the patentee is subjected from an improper or imperfect preparation of his application. From this it will easily be seen that a patent may be obtained for any invention, and that it is not confined to any class or sex, nor does it require to be complicated or expensive.

It will also be seen that the value of a patent depends as much, if not more, upon the manner in which the specification is prepared than upon the merits of the invention itself.

The inventors of Canada are as yet but few in number compared to those of other countries, and yet we possess the same knowledge of sciences as they. To what then is the difference due? This question has often been asked, but the reply is wanting. Encouragement to this class must be held out for society owes much to them. With this view the Board of Arts and Manufactures have opened their library, containing all the English specifications and drawings of patents, as also the reports of the patent commissioners on the various laws in force throughout the world, to which they cordially invite all seeking information on these subjects. They are adding various practical, scientific and instructive works from time to time, and hope shortly to be in a position to open in their new building a museum, where all the improvements in manufactures will be exhibited. The Patent Bill prepared by them has for its object the encouragement and protection of the inventor, and I do not hesitate to say that if it once becomes law our inventors will increase in number and our inventions in value.

Selected Articles.

EXTRACTS

FROM THE ADDRESS OF MR. FAIRBAIRN, PRESIDENT OF THE BRITISH ASSOIATION.

Astronomy.

Our knowledge of the physical constitution of the central body of our system seems likely, at the present time, to be much increased. The spots on the sun's disc were noticed by Galileo and his contemporaries, and enabled them to ascertain the time of its rotation and the inclination of its axis. They also correctly inferred from their appearance, the existence of a luminous envelope, in which funnel-shaped depressions revealed a round dark nucleus. Just a century ago Alexander Wilson indicated the presence of a second and less luminous envelope beneath the outer stratum, and his discovery was confirmed by Sir William Herschel, who was led to assume the presence of a double stratum of clouds, the upper intensely luminous, the lower grey, and forming the penumbra of the spots. Observations during eclipses have rendered probable the supposition that a third and outermost stratum of imperfect transparency encloses concentrically the other envelopes. Still more recently the remarkable dis-

coveries of Kirchoff and Bunsen require us to believe that a solid or liquid photosphere is seen through an atmosphere containing iron, sodium, lithium, and other metals in a vapofous condition. We must still wait for the application of more perfect instruments, and especially for the careful registering of the appearances of the sun by the photoheliograph of Sir John Herschel, so ably employed by Mr. Warren de la Rue, Mr. Welsh, and others, before we can expect a solution of all the problems thus suggested.

Magnetism.

Guided by the same principles which have been so successful in astronomy, its sister science, magnetism, emerging from its infancy, has of late advanced rapidly in that stage of development which is marked by assiduous and systematic observation of the phenomena, by careful analysis and presentation of the facts which they disclose, and by the grouping of these in generalizations, which, when the basis on which they rest shall be more extended, will prepare the way for the conception of a general physical theory, in which all the phenomena shall be comprehended, while each shall receive its separate and satisfactory explanation. It is unnecessary to remind you of the deep interest which the British Association has at all times taken in the advancement of this branch of natural knowledge, or of the specific recommendations which, made in conjunction with the Royal Society, have been productive of such various and important results. To refer but to a single instance: we have seen those magnetic disturbances, so mysterious in their origin and so extensive in simultaneous prevalence—and which, less than twenty years ago, were designated by a term specially denoting that their laws were wholly unknown—traced to laws of periodical recurrence, revealing, without a doubt, their origin in the central body of our system, by inequalities which have for their respective periods the solar day, the solar year, and, still more remarkably, an until lately unsuspected solar cycle of about ten of our terrestrial years, to whose existence they bear testimony in conjunction with the solar spots, but whose nature and causes are in all other respects still wrapped in entire obscurity. We owe to General Sabine, especially, the recognition and study of these and other solar magnetic influences and of the magnetic influence of the moon similarly attested by concurrent determinations in many parts of the globe, which are now held to constitute a distinct branch of this science not inappropriately named "celestial," as distinguished from purely terrestrial magnetism.

Chemistry.

What would now be the condition of calico-printing, bleaching, dyeing, and even agriculture itself, if they had been deprived of the aid of theoretic chemistry? For example, aniline—first discovered in coal tar, by Dr. Hoffman, who has so admirably developed its properties—is now most extensively used as the basis of red, blue, violet, and green dyes. This important discovery will probably, in a few years, render this country independent of the world for dye stuffs; and it is more than probable that England, instead of drawing her dye stuffs from foreign countries, may herself become the centre from which all the world will be supplied.

Light.

It is an interesting fact that, at the same time, in another branch of this science, M. Tournet has lately demonstrated that the colors ot gems, such as the emerald, aqua-marina, amethyst, smoked rock crystal, and others, are due to volatile hydro-carbons, first noticed by Sir David Brewster in clouded topas, and that they are not derived from metallic oxides, as has hitherto been believed. Another remarkable advance has recently been made by Bunsen and Kirchoff in the application of the colored rays of the prism to analytical research. We may consider their discoveries as the commencement of a new era in analytical chemistry, from the extraordinary facilities they afford in the qualitative detection of the minutest traces of elementary bodies. The value of this method has been proved by the discovery of the new metals Cæsim and Rubidium by M. Bunsen, and it has yielded another remarkable result in demonstrating the existence of iron and six other known metals in the sun. In noticing the more recent discoveries in this important science I must not pass over in silence the valuable light which chemistry has thrown upon the composition of iron and steel.

Iron.

Although Despretz demonstrated many years ago that iron would combine with nitrogen, yet it was not until 1857 that Mr. C. Binks proved that nitrogen is an essential element of steel, and more recently M. Carou and M. Fremy have further elucidated this subject; the former showing that cyanogen, or cyanide of ammonium, is the essential element which converts wrought iron into steel; the latter combining iron with nitrogen through the medium of ammonia, and then converting it into steel by bringing it at the proper temperature into contact with common coal gas. There is little doubt that in a few years these discoveries will enable Sheffield manufacturers to replace their present uncertain, cumbrous, and expensive process by a method at once simple and inexpensive, and so completely under control as to admit of any required degree of conversion being obtained with absolute certainty. Mr. Crace Calvert, also, has proved that cast iron contains nitrogen, and has shown that it is a definite compound of carbon and iron mixed with various proportions of metallic iron, according to its nature.

Platinum.

Before leaving chemical science, I must refer to the interesting discovery by M. Deville, by which he succeeded in rapidly melting 38 or 40 lb. of platinum—a metal till then considered almost infusible. This discovery will render the extraction of platinum from the ore more perfect, and by reducing its cost, will greatly facilitate its application to the arts.

Geology.

It is little more than half a century since geology assumed the distinctive character of a science. Taking into consideration the aspects of nature in different epochs of the history of the earth, it has been found that the study of the changes at present going on in the world around us enables us to understand the past revolutions of the globe, and the conditions and circumstances under which strata have been formed and organic remains embedded and preserved. The geologist has increasingly tended to believe that the changes which have taken place on the face of the globe, from the earliest times to the present, are the result of agencies still at work. But while it is his high office to record the distribution of life in past ages, and the evidence of physical changes in the arrangement of land and water,

his results hitherto have indicated no traces of its beginning, nor have they afforded evidence of the time of its future duration. As an example of the application of geology to the practical uses of life, I may cite the discovery of the goldfields of Australia, which might long have remained hidden but for the researches of Sir Roderick Murchison in the Ural Mountains on the geological position of the strata from which the Russian gold is obtained. From this investigation he was led by inductive reasoning to believe that gold would be found in similar rocks, specimens of which had been sent him from Australia. The last years of the active life of this distinguished geologist have been devoted to the re-examination of the rocks of his native Highlands of Scotland. Applying to them those principles of classification which he long since established, he has demonstrated that the crystaline limestone and quartz rocks which are associated with mica-schists, &c., belong by their embedded organic remains to the lower silurian rocks. Descending from this well-marked horizon, he shows the existence beneath all such fossiliferous strata of vast masses of sandstone and conglomerate of Cambrian age; and, lastly, he has proved the existence of a fundamental gneiss, on which all the other rocks repose, and which, occupying the north-western Hebrides and the west coasts of Sutherland and Ross, is the oldest rock formation on the British Isles, it being unknown to England, Wales, or Ireland.

The Earth's Crust.

It is well known that the temperature increases as we descend through the earth's crust, from a certain point near the surface, at which the temperature is constant. In various mines, borings, and Artesian wells, the temperature has been found to increase about 1 deg. Fah. for every 60ft., or 65ft. of descent. In some carefully conducted experiments during the sinking of Dukinfield Deep Mine, one of the deepest pits in the country, it was found that a mean increase of about 1 deg. in 71 ft.occurred. If we take the ratio thus indicated, and assume it to extend to much greater depths, we should reach at two-and-a-half miles from the surface strata at the temperature of boiling water; and at depth of about 50 or 60 miles the temperature would be sufficient to melt, under the ordinary pressure of the atmosphere, the hardest rocks. Reasoning from these facts, it would appear that the mass of the globe, at no great depth, must be in a fluid state. But this deduction requires to be modified by other considerations, namely, the influence of pressure on the fusing point, and the relative conductivity of the rocks which form the earth's crust. To solve these questions a series of important experiments were instituted by Mr. Hopkins, in the prosecution of which Dr. Joule and myself took part; and after a long and laborious investigation it was found that the temperature of fluidity increased about 1 deg. Fah. for every 500 lb. of pressure in the case of spermaceti, bees-wax, and other similar substances. However, on extending these experiments to less compressible substances, such as tin and barytes, a similar increase was not observed. But this series of experiments has been unavoidably interrupted, nor is the series on the conductivity of rocks entirely finished. Until they have been completed by Mr. Hopkins we can only make a partial use of them in forming an opinion of the thickness of the earth's solid crust. Judging, however, alone from the greater conductivity of the igneous rocks, we may calculate that the thickness cannot possibly be less than nearly three times as great as that calculated on the usual suppositions of the conductive power of the terrestrial mass at enormous depths being no greater than that of the superficial sedimentary beds. Other modes of investigation which Mr. Hopkins has brought to bear on this question appear to lead to the conclusion that the thickness of the earth's crust is much greater even than that above stated. This would require us to assume that a part of the heat in the crust is due to superficial and external rather than central causes. This does not bear directly against the doctrine of central heat, but shows that only a part of the increase of temperature observed in mines and deep wells, is due to the outward flow of that heat.

Mechanical Science—Canals.

One hundred years ago the only means for the conveyance of inland merchandise were the pack-horses and waggons on the then imperfect highways. It was reserved for Brindley, Smeaton and others to introduce a system of canals, which opened up facilities for an interchange of commodities at a cheap rate over almost every part of the country. The impetus given to industrial operations by this new system of conveyance induced capitalists to embark in trade, in mining, and in the extension of manufactures in almost every district. These improvements continued for a series of years, until the whole country was intersected by canals requisite to meet the demands of a greatly extended industry. But canals, however well adapted for the transport of minerals and merchandise, were less suited for the conveyance of passengers. The speed of the canal boats seldom exceeded from two-and-a-half to three miles an hour, and in addition to this the projectors of canals sometimes sought to take an unfair advantage of the Act of Parliament, which fixed the tariff at so much per ton per mile, by adopting circuitous routes, under the erroneous impression that mileage was a consideration of great importance in the success of such undertakings. It is in consequence of short.sighted views and imperfect legislation that we inherit the numerous curves and distortions of our canal system. These defects in construction rendered canals almost useless for the conveyance of passengers, and led to the improvement of the common roads and the system of stage coaches; so that, before the year 1830, the chief public highways of the country had attained a remarkable smoothness and perfection, and the lightness of our carriages and the celerity with which they were driven, still excite the admiration of those who remember them. These days of an efficiently worked system, which tasked the power and speed of the horse to the utmost, have now been succeeded by changes more wonderful than any that previously occurred in the history of the human race.

Steamers.

Scarcely had the canal system been fully developed when a new means of propulsion was adopted—namely, steam. I need not recount to you the enterprise, skill, and labour that have been exerted in connection with steam navigation. You have seen its results on every river and every sea; results

we owe to the fruitful minds of Miller, Symington, Fulton, and Henry Bell, who were the pioneers in the great march of progress. Viewing the past, with a knowledge of the present and a prospect of the future, it is difficult to estimate sufficiently the benefits that have been conferred by this application of mechanical science to the purposes of navigation. Power, speed, and certainty of action have been attained on the most gigantic scale. The celerity with which a modern steamer, with a thousand tons of merchandise and some hundreds of human beings on boards, cleaves the water and pursues her course far surpasses the most sanguine expectations of a quarter of a century ago, and indeed almost rivals the speed of the locomotive itself. Previous to 1812 our intercourse with foreign countries and with our colonial possessions depended entirely upon the state of the weather. It was only in favourable seasons that a passage was open, and we had often to wait days, or even a week, before Dublin could be reached from Holyhead. Now this distance of 63 miles is accomplished in all weathers in little more than three hours. The passage to America used to occupy six weeks or two months; now it is accomplished in eight or nine days. The passage round the cape to India is reduced from nearly half a year to less than a third of that time, while that country may be reached by the overland route in less than a month. These are a few of the benefits derived from steam navigation, and, as it is yet far from perfect, we may reasonably calculate on still greater advantages in our intercourse with distant nations. I will not here enter upon the subject of the numerous improvements which have so rapidly advanced the progress of this important service. Suffice it to observe that the paddle-wheel system of propulsion has maintained its superiority over every other method yet adopted for the attainment of speed, as by it the best results are obtained with the least expenditure of power. In ships of war the screw is indispensible, on account of the security it affords to the engines and machinery, from their position in the hold below the water line, and because of the facility it offers in the use of sails, when the screw is raised from its position in the well to a recess in the stern prepared for that purpose. It is also preferable in ships which require auxiliary power in calms and adverse winds, so as to expedite the voyage and effect a considerable saving upon the freight.

Railways.

The public mind had scarcely recovered itself from the changes which steam navigation had caused, and the impulse it had given to commerce, when a new and even more gigantic power of locomotion was inaugurated. Less than a quarter of a century had elapsed since the first steamboats floated on the Hudson and the Clyde, when the achievements thence resulting were followed by the application of the same agency to the almost superhuman flight of the locomotive and its attendant train. I well remember the completion at Rainhill in 1830, and the incredulity everywhere evinced at the proposal to run locomotives at twenty miles an hour. Neither George Stephenson himself, nor any one else, had at that time the most distant idea of the capabilities of the railway system. On the contrary, it was generally considered impossible to exceed ten or twelve miles an hour; and our present high velocities, due to high-pressure steam and the tubular system of boilers, have surpassed the most sanguine expectations of engineers. The sagacity of George Stephenson at once seized upon the suggestion of Henry Booth, to employ tubular boilers; and that, united to the blast-pipe, previously known, has been the means of effecting all the wonders we now witness in a system that has done more for the development of practical science, and the civilisation of man, than any discovery since the days of Adam.

The Steam Engine.

From a consideration of the changes which have been effected in the means for the interchange of commodities I pass on to examine the progress which has been made in their production. And, as the steam-engine has been the basis of all our modern manufacturing industry, I shall glance at the steps by which it has been perfected. Passing over the somewhat mythical fame of the Marquis of Worcester, and the labours of Savery, Beighton, and Newcomen, we come at once to discuss the state of mechanical art at the time when James Watt brought his gigantic powers to the improvement of the steam engine. At that time the tools were of the rudest construction, nearly everything being done by hand, and, in consequence, wood was much more extensively employed than iron. Under these circumstances, West invented separate condensation, rendered the engine double acting, and converted its rectilinear motion into a circular one suitable for the purposes of manufacture. But the discovery at first made little way, the public did not understand it, and a series of years elapsed before the difficulties, commercial and mechanical, which opposed its application, could be overcome. When the certainty of success had been demonstrated, Watt was harassed by infringements of his patent, and lawsuits for the maintenance of his rights. Inventors, and pretended inventors, set up claims, and entered into combination with manufacturers, miners, and others, to destroy the patent and deprive him of the just fruits of his labour and genius. Such is the selfish heartlessness of mankind in dealing with discoveries not their own, but from which they expect to derive benefit. The steam engine, since it was introduced by Watt, has changed our habits in almost every condition of life. Things which were luxuries have become necessaries, and it has given to the poor man in all countries in which it exists a degree of comfort and independence and a participation in intellectual culture unknown before its introduction. It has increased our manufactures tenfold, and has lessened the barriers which time and space interpose. It ploughs the land and winnows and grinds the corn. It spins and weaves our textile fabrics. In mining it pumps, winds, and crushes the ores. It performs these things with powers so great and so energetic as to astonish us at their immensity, while they are at the same time perfectly docile, and completely under human control.

Textile Manufactures.

The extraordinary developments of practical science in our system of textile manufactures are, however, not entirely due to the steam engine, although they are now in a great measure dependent on it. The machinery of these manufactures had its origin before the steam engine had been applied, except for mining purposes; and the inventions of Arkwright, Hargreaves, and Crompton were not conceived under the impression that steam would be their moving power. On the contrary, they depended upon water; and the cotton machinery of this

district had attained considerable perfection before steam came to the aid of the manufacturer, and ultimately enabled him to increase the production to its present enormous extent. I shall not attempt a description of the machinery of the textile manufactures, because ocular inspection will be far more acceptable. I can only refer you to a list of establishments in which you may examine their operations on a large scale, and which I earnestly recommend to your attention. I may, however, advert to a few of the improvements which have marked the progress of the manufacturing system in this country. When Arkwright patented his water-frames, in 1767, the annual consumption of cotton was about 4,000,000 lb. weight. Now it is 1,200,000,000 lb. weight—300 times as much.

Cotton.

Within half a century the number of spindles at work, spinning cotton alone, has increased tenfold; while, by superior mechanism, each spindle produces 50 per cent more yarn than on the old system. Hence the importance to which the cotton trade has risen, equalling, at the present time, the whole revenue of the three kingdoms, or £70,000,000 stg. per annum. As late as 1820 the power-loom was not in existence; now it produces 14,000,000 yards of cloth, or, in more familiar terms, nearly 8,000 miles of cloth per diem. I give these particulars to show the immense power of production of this country, and to afford some conception of the number and quality of the machines which effect such wonderful results. Mule spinning was introduced by Crompton, in 1787, with about twenty spindles to each machine. The powers of the machine were, however, rapidly increased; and now it has been so perfected that 2,000 or even 3,000 spindles are directed by a single person. At first the winding on, or forming the shape of the cop, was performed by hand; but this has been superseded by rendering the machine automatic, so that it now performs the whole operation of drawing, stretching, and twisting the thread, and winding it on to the exact form, ready for the real or shuttle, as may be required. These and other improvements in carding, roving, combing, spinning, and weaving, have established in this country an entirely new system of industry; it has given employment to greatly increased numbers, and a more intelligent class of workpeople. Similarly important improvements have been applied to the machinery employed in the manufacture of silk, flax and wool, and we have only to watch the processes in these different departments to be convinced that they owe much to the development of the cotton manufacture. In the manufacture of worsted the spinning jenny was not employed at Bradford until 1799, nor the power-loom until about 1825.

Alpaca.

The production of fancy or mixed goods from alpaca and mohair wool, introduced to this country in 1836, is, perhaps, the most striking example of a new creation in the art of manufacture, and is chiefly due to Mr. Titus Salt, in whose immense palace of industry, at Saltaire, it may be seen in the greatest perfection. In flax machinery the late Sir Peter Fairbairn was one of the most successful inventors, and his improvements have contributed to the rapid extension of his manufacture. I might greatly extend this description of our manufacturing industry but I must for the present be brief, in order to point out the dependence of all these improvements on the iron and coal so widely distributed among the mineral treasures of our island.

Manufacture of Iron.

Previously to the invention of Henry Cort the manufacture of wrought iron was of the most crude and primitive description. A hearth and a pair of bellows was all that was employed. But since the introduction of puddling the iron-masters have increased the production to an extraordinary extent, down to the present time, when processes for the direct conversion of wrought iron on a large scale are being attempted. A consecutive series of chemical researches into the different processes, from the calcining of the ore to the production of the bar, carried on by Dr. Percy and others, has led to a revolution in the manufacture of iron; and, although it is at the present moment in a state of transition, it nevertheless requires no very great discernment to perceive that steel and iron of any required tenacity will be made in the same furnace with a facilty and certainty never before attained. This has been effected to some extent by improvements in puddling, but the process of Mr. Bessemer—first made known at the meetings of this association at Cheltenham—affords the highest promise of certainty and perfection in the operation of converting the melted pig direct into steel or iron, and is likely to lead to the most important developments in this manufacture. These improvements in the production of the material must, in their turn, stimulate its application on a larger scale, and lead to new constructions.

Ship Building.

In iron shipbuilding an immense field is opening before us. Our wooden walls have, to all appearance, seen their last days; and, as one of the early pioneers in iron construction, as applied to shipbuilding, I am highly gratified to witness a change of opinion that augers well for the security of the liberties of the country. From the commencement of iron shipbuilding, in 1830, to the present time, there could be only one opinion among those best acquainted with the subject—namely, that iron must eventually supersede timber in every form of naval construction. The large ocean steamers, the Himalaya, the Persia, and the Great Eastern, abundantly show what can be done with iron, and we have only to look at the new system of casing ships with armour plates to be convinced that we can no longer build wooden vessels of war with safety to our naval superiority and the best interests of the country. I give no opinion as to the details of the reconstruction of the navy—that is reserved for another place—but I may state that I am fully persuaded that the whole of our ships of war must be rebuilt of iron, and defended with iron armour calculated to resist projectiles of the heaviest description at high velocities. In the early stages of iron shipbuilding, I belive I was the first to show, by a long series of experiments, the superiority of wrought iron over every other description of material in security and strength, when judiciously applied in the construction of ships of every class. Other considerations, however, affect the question of vessels of war; and although numerous experiments were made, yet none of the targets were on a scale sufficient to resist more than a six-pounder shot. It was reserved for our scientific neighbours, the French, to introduce thick iron plates as a defensive armour for ships. The success which has attended the adoption of this new system

of defence affords the prospect of invulnerable ships of war, and hence the desire of the Government to remodel the navy on an entirely new principle of construction, in order that we may retain its superiority as the great bulwark of the nation.

Bridges.

We have already seen a new era in the history of the construction of bridges, resulting from the use of iron; and we have only to examine those of the tubular form over the Conway and Menai Straits to be convinced of the durability, strength, and lightness of tubular construction applied to the support of railways or common roads in spans which ten years ago were considered beyond the reach of human skill. When it is considered that stone bridges do not exceed 150ft. in span, nor cast iron bridges 250ft., we can estimate the progress which has been made in crossing rivers 400 or 500ft. in width without any support at the middle of the stream. Even spans greatly in excess of this may be bridged over with safety provided we do not exceed 1,800 to 2,000ft., when the structure would be destroyed by its own weight.

Sanitary Measures.

In former days 10 gallons of water to each person per day was considered an ample allowance. Now 30 gallons is much nearer the rate of consumption. I may instance the waterworks of this city and of Liverpool, each of which yield a supply of from 20 gallons to 30 gallons of water to each inhabitant. In the former case the water is collected from the Cheshire and Derbyshire hills, and, after being conveyed in tunnels and aqueducts a distance of ten miles to a reservoir, where it is strained and purified, it is ultimately taken a further distance of eight miles in pipes, in a perfectly pure state, ready for distribution. The greatest undertaking of this kind, however, yet accomplished, is that by which the pure waters of Loch Katrine are distributed to the city of Glasgow. This work, recently completed by Mr. Bateman, who was also the constructor of the waterworks of this city, is of the most gigantic character, the water being conveyed in a covered tunnel a distance of 27 miles, through an almost impassable country, to the service reservoir, about eight miles from Glasgow. By this means 40 million gallons of water per day are conveyed through the hills which flank Ben Lomond, and after traversing the sides of Loch Chon and Loch Aird, are finally discharged into the Mudgdock Basin, where the water is impounded for distribution. We may reasonably look forward to an extension of similar benefits to the metropolis, by the same engineer, whose energies are now directed to an examination of the pure fountains of Wales, from whence the future supply of water to the great city is likely to be derived. A work of so gigantic a character may be looked upon as problematical, but when it is known that six or seven millions of money would be sufficient for its execution, I can see no reason why an undertaking of so much consequence to the health of London should not ultimately be accomplished.

Mr. Whitworth.

To Mr. Whitworth mechanical science is indebted for some of the most accurate and delicate pieces of mechanism ever executed; and the exactitude he has introduced into every mechanical operation will long continue to be the admiration of posterity. His system of screw threads and guages is now in general use throughout Europe. We owe to him a machine for measuring with accuracy to the millionth of an inch, employed in the production of standard guages; and his laborious and interesting experiments on rifled ordnance have resulted in the production of a rifled small arm and gun, which has never been surpassed for range and precision of fire.

Telegraphs.

A brief allusion must be made to that marvellous discovery which has given to the present generation the power to turn the spark of heaven to the uses of speech; to transmit along the slender wire for a thousand miles a current of electricity that renders intelligible words and thoughts. This wonderful discovery, so familiar to us, and so useful in our communications to every part of the globe, we owe to Wheatstone, Thomson, De la Rive, and others. In land telegraphy the chief difficulties have been surmounted, but in submarine telegraphy much remains to be accomplished. Failures have been repeated so often as to call for a commission on the part of the Government to inquire into the causes, and the best means of overcoming the difficulties which present themselves. I had the honour to serve on that commission, and I believe that from the report, and mass of evidence and experimental research accumulated, the public will derive very important information. It is well known that three conditions are essential to success in the construction of ocean telegraphs—perfect insulation, external protection, and appropriate apparatus for laying the cable safely on its ocean bed. That we are far from having succeeded in fulfilling these conditions is evident from the fact, that out of 12,000 miles of submarine cable which have been laid since 1851, only 3,000 miles are actually in working order; so that three-fourths may be considered as a failure and loss to the country. The insulators hitherto employed are subject to deterioration from mechanical violence, from chemical decomposition or decay, and from the absorption of water; but the last circumstance does not appear to influence seriously the durability of cables. Electrically, india-rubber possesses high advantages, and, next to it, Wray's compound and pure gutta percha far surpass the commercial gutta percha hitherto employed; but it remains to be seen whether the mechanical and commercial difficulties in the employment of these new materials can be successfully overcome. The external projecting covering is still a subject of anxious consideration. The objections to iron wire are its weight and liability to corrosion. Hemp has been substituted, but at present with no satisfactory result. All these difficulties, together with those connected with the coiling and paying out of the cable, will no doubt yield to careful experiment and the employment of proper instruments in its construction, and its final deposit on the bed of the ocean. Irrespective of inland and international telegraphy, a new system of communication has been introduced by Professor Wheatstone, whereby intercourse can be carried on between private families, public offices, and the works of merchants and manufacturers. This application of electric currents cannot be too highly appreciated, from its great efficiency and comparatively small expense. To show to what an extent this improvement has been carried I may state that 1,000 wires, in a perfect state of insulation, may be formed into a rope not exceeding ½ in. in diameter.

ON WASTE.

"*Gather up the fragments—let nothing be lost,*" is a divine injunction for us in every age. We recognize it most strictly, I hope, with regard to our food, but, perhaps, we are not so particular with regard to the fragments that are likely to be lost in our manufacturing operations. If we look abroad upon the world, and see how God is governing the universe—see how he is correlating the powers of nature, and the properties of matter, we shall see, there, indeed, that nothing is lost; we shall find that no force ever assumed by an atom of matter is wasted. Matter is perpetually changing its forms, but whilst changing its forms it is ever subserving some use in nature. Man should study these laws, and examine the works of the hand and finger of the great Creator in the external world, and try to imitate him. It is man's privilege to be created in the image of his Creator; it is his privilege to follow in the footsteps of his Creator. He is placed here the monarch of the world, and it is only as he fails to understand his duties in attaining a knowledge of the laws of the external world, that he suffers pains and penalties. I want to show you that if we imitate in our manufacturing processes the great laws of nature, we shall save much, and we shall also diminish our labour and multiply our sources of happiness on the earth. We can see it in some things more obviously than in others. We can see it in the mineral world. When the workmen is at work on the diamond, he suffers not a grain of its dust to be lost or wasted, but hoards it up for future use. So with the workmen in gold and silver. We find that the particles of dust that escape in various directions are carefully collected;—and it is not less true with regard to vegetable products. We see the shavings and sawdust of the carpenter and cabinet maker carefully collected together for other purposes and uses in the arts and manufacturing operations; and it ought to be no less so in the animal kingdom, in the use of the animal products. With this view, I propose to-night to see whether there have not been some fragments thrown away in the manufacturing operations we have spoken of, that we may point out how that which is now lost may be saved.

There is an anecdote told of a distinguished chemist, who was asked how he had made his great discoveries, and he replied that it was by examining that which other chemists threw away. So many a manufacturer may make his fortune by using that which others throw away.

In the first instance I will call your attention to the chemical, physical, and general properties of the materials of which we have been speaking. We spoke of these to some extent in the first Lecture; we saw that the animal tissues possessed certain properties which made them valuable in the arts, and we found that these substances were formed of certain chemical elements which exhibited definite chemical properties; and we shall see that a result of this study is a knowledge of the application to the arts of life of those substances which would otherwise be lost and thrown away.

I purpose first to examine some of the substances which, on account of their physical properties, are now recovered, and which at one time were regarded as waste. I spoke to you first of silk, and I referred to the way in which the silk is wound off the cocoons, and how it is rolled and afterwards spun, and formed into a variety of garments.

During the operation of spinning there is a quantity of loose silk, which would be entirely lost but that pains are taken to collect it in a rough state; it is then pulled out, and the fibres again reeled, and it is manufactured into the lower kinds of silk. The waste of this process is collected again, and again it is re-reeled and wound; so that not a fibre is lost. After the silk of the cocoons has been wound off, there still remains a quantity of silk upon the used cocoon, which, under the name of "knubs and husks," is imported iuto this country. The knubs and husks are torn to pieces, and the fibre is reeled and woven into the lower sorts of silks; so that there ought to be no waste in silk at all. I told you, I think, that the Chinese even eat the grub within the cocoon.

I pass on from silk to wool. During the process of spinning and weaving wool, there is a quantity of waste—a quantity of the hair is left; but this is now collected, and applied in a variety of ways. Some of the better kinds of this waste wool can be used and mixed with higher sorts, and are thus worked up. We find that, after the cloth is woven, the ends are cut off, under the name of *list*, which is again torn to pieces and re-wound. There is also from such waste portions an extensive manufacture carried on of the substance known by the name of flock. The wool is ground down to a powder, and mixed with colouring matters, such as vermillion for red, chromate of lead for yellow, arsenite of of copper for green; so that the flocks assume a variety of colours; and these coloured flocks are used for the purpose of manufacturing what are called flock papers. The paper is figured in a variety of ways, and the figures are covered over with size or gum, and the flock is powdered over it: it is then called flock-paper. This process was first patented by a Frenchman named Jerome Lanyer, in 1634, and since this time there has been a considerable manufacture of flock-papers in this country. It has, however, reached great perfection on the continent, and the French have paid particular attention to the patterns. These flocks, then, have been produced by the refuse of the woollen manufacture.

I would here say one word with regard to the colouring matters of flock-papers, as it is a matter of importance. They should not be mixed with poisonous substances. The greens are mostly made with arsenite of copper; and instances have not been rare of persons living in rooms where these green flock-papers have been used; and the consequence has been, that when the paper has been brushed, the particles of arsenite of copper have got into the air, have been taken into the lungs, and produced injurious effects on the system. I do not know that it is so deadly a thing as represented, but it seems an imprudent thing for people to live in rooms covered with these green papers. Wherever these flock-papers are used, they accumulate a greater quantity of dust than other papers, and consequently require to be brushed oftener. It is undoubtedly much the most wise and prudent plan in the case of paint, and in the case of all substances employed in rooms where persons live, that they should not contain poison.

This arsenite of copper has been the source of a variety of suffering in many directions. It is sometimes used to colour confectionary, and I have known

children killed by it. The green fields and green trees looking so pretty, with the white sheep feeding on the top of twelfth-cakes, have been known to contain arsenite of copper. I recollect a case of a number of people being poisoned at a dinner-party by eating some nice green *blanc mange*, which had been coloured with arsenite of copper. With yellow orpiment, a sulphide of arsenic, some boys were recently poisoned by eating Bath Buns made yellow by this substance.

Now let me draw your attention to the fact that the wool, after it has been used—after it has been worn, has its analogue in the rags of linen and cotton clothing. You know how desperate has been the condition of the paper manufacturer because he cannot get a supply of rags for his manufacture. The woollen manufacturer has been saved from the same state by a material which is produced under the name of "shoddy," and which is extensively used in the manufacture of clothing of common quality, such as pilot-coats, ladies' mantles, druggets, and the cheaper kind of carpeting. This material is not made of new wool, but of wool that has been worn and afterwards torn to pieces by machinery. This shoddy has various prices in the market, according to the substances from which it comes, and you will find the specimens of the material under various names, such as "black and grey army clippings." I suppose they are the torn up clothes of soldiers, who, probably, have been in the field of battle, and having come back, have sold their clothes second hand. Then we have "seamed middle white," I do not know what kind of cloth that has been. Then "scarlet cloth." Then there is "Hamburg blue stocking shoddy," and shoddy from "black stuffs," from "brown stuffs," from "white serge," from "druggets," and "carpets." I mention these names to show you what a variety of substances are thus torn up, and made again into new cloth. Some forms of this shoddy are called "mungo." Thus we have "blue mungo," "brown mungo," "grey mungo," "claret and white mungos;" and there are now shoddy markets, just as there are woollen markets, and the shoddy markets are increasing every day. One principal seat of this manufacture is Dewsbury, in Yorkshire. It has, however, found its way into Leeds, Wakefield, and to all the large woollen-manufacturing towns Those who are skilled in the knowledge of real woollen cloth can easily distinguish between it and shoddy. This trade has been sometimes objected to on account of its appearing to produce an article of a superior kind with an inferior raw material; but, after all, you will find that these shoddies are not sold at the price of superfine cloths, and are good substitutes for them. The cheap clothing of late years has depended upon the introduction of this shoddy, and, provided the price is not larger than gives the fair profit to the manufacturer, we cannot object to it, as it enables many a man to put on, at least once a week, a decent looking coat, who otherwise would not have a cloth coat at all; and if the wear only answers to the price given, I do not think any one can find fault. However, I have heard a gentleman say he objected to stockings of shoddy, which he could not put on without putting his feet through them, and to coats that split up the first time they were put on. In this case the purchaser must judge for himself, for there is no attempt to sell them as superfine cloth,—they are sold as shoddy. I introduce this subject to you to show you that it is one of the uses of waste substances. I shall show you that even after wool has been manufactured into shoddy, it has still further uses in the arts. It has recently been observed that "there is still some mill waste which cannot be used up again for "shoddy." It is that portion of the wool waste which is so saturated with oil and grease that the fatty matter is heavier than the wool in it: it is called "creasb." This is one one of the most powerful fertilizers. Those farmers who laid it upon land several years ago are seeing the advantage of it every succeeding year; for it it does not give out its strength to the crops all at once though by a chemical process it could be made to yield its nourishment as speedily and be as good as guano to the enterprising agriculturalist. The attention of the agricultural chemist may also be directed to the quantity of liquid manure in the soap suds and washings, &c., which run to waste from the mills. This liquid contains the best fertilizing elements which can be found; indeed, farmers are in the habit of paying £7 a ton for substances which can do less good to their crops than despised 'soap-suds' would do."—*Uses of Animals.*

POWER OF THE MICROSCOPE.

ON NOBERT'S TEST PLATE AND THE STRIÆ OF DIATOMS, BY W. S. SULLIVANT AND T. G. WORMLEY.

The limit of the resolvability of lines, or how small a space can exist between lines and still admit of their being separated under the microscope, appears to be an undecided point. Professor Queckett ("Treatise on the Microscope," third edition, p. 238, 1855) asserts that "no achromatic has yet been made capable of separating lines closer together than the $\frac{1}{75000}$th of an inch. In the same work, p. 245, it is stated that Mr. Ross found it impossible to ascertain the position of a line nearer than the $\frac{1}{80000}$th of an inch. We also find on p. 512 that Mr. De La Rue, in his extended examination of Nobert's test plates, was unable to resolve any lines closer than the $\frac{1}{81000}$th of an inch. In Professor Carpenter's work ("The Microscope," second edition, p. 189, 1859), this sentence occurs:—"The well defined lines on Nobert's test plates, have not yet been resolved when they have approximated more closely than the $\frac{1}{85000}$th of an inch."

From the foregoing, it appears that actual experiment fixes the limit of resolvability at about $\frac{1}{81000}$th of an inch. This does not, as is said, vary widely from the deductions of Fraunhofer and others, based on the physical properties of light. In this connection the remark (*op. cit.*, p. 47) of Professor Carpenter may be cited, "there is good reason to believe that the limit of perfection (in the objective) has now been nearly reached, since everything which seems theoretically possible has been actually accomplished."

On the other hand there are authorities who assert that lines much closer than the $\frac{1}{85000}$th of an inch are resolvable. A few years since Messrs. Harrison and Sollitt published (*Microscopical Journal*, vol. ii., p. 61. 1854) their measurements of the striæ of several diatoms, assigning to Amphipleura pellucida striæ as close as the $\frac{1}{120000}$th to $\frac{1}{130000}$th of an inch. These measurements have recently been repeated, and with exactly the same results, by Mr. Sollitt alone (*Mic. Journal.*, viii., p. 51, 1859), who furthermore

expresses the opinion that striæ as close as the $\frac{1}{175000}$th of an inch, can, with proper means, be seen. Mr. Sollitt's measurements have been adopted in the Micrographic Dictionary (1860) and most of the modern works on the Microscope, no one, Professor Carpenter (*op. cit.*, p. 188) excepted, suggesting a doubt as to their accuracy; on the contrary, their correctness seems to be expressly recognised by Dr. G. C. Wallich ("Ann. and Mag, Nat. Hist." for February, 1860).

Such being the conflicting testimony and opinion of distinguished microscopists on the capacity of the modern objective for separating lines, it is somewhat surprising—in view of the high state of perfection now attained by the microscope, and of the number of its zealous devotees—that so few experiments have been made bearing on this interesting point.

As a contribution toward that object, we propose to offer presently an analysis from actual measurements, as far as we were able to carry them, of one of those "marvels of Art," Nobert's Test Plates. In such investigations the quality of the instruments used being all-important, we would state that the optical apparatus at our command was ample, consisting of a first-class Smith and Beck microscope stand, a Tolles' $\frac{1}{50}$ objective of 160° angular aperture,—an objective of rare excellence in all respects,—besides $\frac{1}{12}$ths and $\frac{1}{16}$ths of other eminent opticians, both English and American; also a solid eye-piece micrometer by Tolles, and an improved cobweb micrometer of Grunow's accurate workmanship. Smith and Beck's stage scales furnished the standards for fixing the micrometrical values of the eye-pieces. By means of Tolles' amplifier, an achromatic concavo-convex lens between the objective and the eye-piece, an amplification (by the standard of 10 inches) as high as 6000 times was obtained. This high amplification, with sunlight variously applied after passing through a small achromatic lens of long focus, was effective in resolution, and essential to the distinct counting under the micrometer, of the lines of the test plate. The test plate used consisted of 30 bands of lines, each band varying but little from the $\frac{1}{2000}$th of an inch in width, and having its lines a uniform distance apart. On one end of the plate is engraved by Nobert, in parts of the Paris line, the distance apart of the lines composing the first band, and thence on, the distance between the lines of every fifth band, as in the second and fifth columns of the following table:—

Band.	Par. line.	English in.	Band.	Par. line.	Eng. in.
1	0.001000	$\frac{1}{11248}$	20	0.000167	$\frac{1}{67413}$
5	0.000550	$\frac{1}{20471}$	25	0.000143	$\frac{1}{78737}$
10	0.000275	$\frac{1}{40943}$	30	0.000125	$\frac{1}{90074}$
15	0.000200	$\frac{1}{56297}$			

We add the third and sixth columns, giving the distances in parts of the English inch found by multiplying the decimals in the second and fifth columns by ·088815.

Analysis of Nobert's Test Plate of Thirty Bands.

Bands.	Lines in each band.	Parts of an English inch.	Bands.	Lines in each band.	Parts of an English inch.
1	7	$\frac{1}{11110}$	7	15	$\frac{1}{27705}$
2	8	$\frac{1}{13062}$	8	17	$\frac{1}{32250}$
3	9	$\frac{1}{15372}$	9	20	$\frac{1}{37792}$
4	10	$\frac{1}{17950}$	10	22	$\frac{1}{40636}$
5	12	$\frac{1}{20224}$	11	24	$\frac{1}{45063}$
6	13	$\frac{1}{23287}$	12	25	$\frac{1}{47331}$
13	26	$\frac{1}{50000}$	22	37	$\frac{1}{71960}$
14	28	$\frac{1}{52610}$	23	38	$\frac{1}{73190}$
15	29	$\frac{1}{55900}$	24	40	$\frac{1}{74256}$
16	30	$\frac{1}{57519}$	25	41	$\frac{1}{76200}$
17	31	$\frac{1}{58623}$	26	42	$\frac{1}{78105}$
18	32	$\frac{1}{62155}$	27	43	$\frac{1}{81213}$
19	33	$\frac{1}{63328}$	28	44?	$\frac{1}{83917}$
20	34	$\frac{1}{66947}$	29		$\frac{1}{86334}$
21	36	$\frac{1}{68047}$	30		

The figures in the third and sixth columns, showing the distance apart of the lines in each band, are the mean of numerous and slightly variant trials, particularly on the higher bands. Up to the twenty-sixth band there was no serious difficulty in resolving and ascertaining the position of the lines, but on this and the subsequent ones, spectral lines,*—that is, lines each composed of two or more real lines,—more or less prevailed, showing that the resolving power of the objective was approaching its limit. By a suitable arrangement however, of the illumination, these spurious lines were separated into the ultimate ones on the whole of the 26th and very nearly on the whole of the 27th band; but on the 28th, and still more on the 29th, they so prevailed that at no one focal adjustment could more than a portion (a third or a fifth part) of the width of these bands be resolved into the true lines.

The true lines of the 30th band we were unable to see, at least with any degree of certainty; still, from indications, we have no doubt they are ruled as stated by Nobert.

It will be observed that our measurements of the lines on the 1st, 5th, 10th, 15th, and 20th bands vary somewhat from Nobert's registration on the plate, as given in the first table above. Such discrepancies are to be expected, and by microscopists familiar with operations of this kind, are looked upon as unavoidable; but that on the 25th band is rather large to be accounted for in this way. We are unable to explain it, and can only say that our repeated measurements of it were very carefully made.

These experiments, together with those of others before noticed, induce us to believe that the limit of the resolvability of lines, in the present state of the objective, is well nigh established; but that this limit may be carried somewhat higher we are not prepared to doubt, since the handsome advance lately achieved by Mr. Tolles in his $\frac{1}{50}$—combining wide aperture, fine definition, and high amplification—shows that the objective had not, as we were inclined to think, reached the stationary point.—*Amer. J. S.*

LESLIE'S PATENT GAS PROCESS.

Two patents of great commercial importance have been taken out by Mr. John Leslie. The first has for its object improvements in the manufacture of gas. Heretofore, in manufacturing gas from coal and other bituminous mineral substances, it has been usual to sub-

* The tendency of lines near the limit, either way, of the objective's resolving power, to run into each other and produce spectral or spurious lines, is readily shown by a low objective on the lower bands. Hence, the mere exhibition of lines is not always conclusive evidence of their ultimate resolution. A practised eye will generally distinguish the false from the true. Recourse to a higher objective often accomplishes the same; but when these fail, the micrometer only, together with a previous knowledge of the actual position of the true lines, can determine whether the lines exhibited are real or spurious. A 1-12th or 1-16th will show the three or four highest bands on this plate regularly and beautifully striped with lines much coarser than the true ones; the same with the 1-30th on the last band.

ject them to the process of destructive distillation, and then to purify the gas obtained. These improvements in the manufacture of gas for the purposes of illumination from parrot coal, cannel coal, boghead coal, and other mineral bituminous matters capable of affording paraffine, consist in subjecting such mineral bituminous matters to distillation at low temperatures, in order to obtain the products distilled over in a condensed liquid form; and then to subject such liquids to processes of purification, in order to fix or remove the ammonia, sulphur and other impurities; and then to subject the purified liquids to destructive distillation, by which very pure gas is obtained. In the manufacture of gas from coal by destructive distillation, as at present practiced in gas-works, it is necessary to employ very extensive, and at the same time, very expensive machinery and processes between the retorts, where the gas is distilled off, and the gasometers, wherein the gas is stored for distribution; and the necessity for the use of such machinery and processes arises from the high temperatures employed in distilling over every vaporizable constituent of the coals employed; by which not only is the illuminating gas distilled off, but also every inferior and deteriorating gases, with products of sulphur and other impure matters, which are prejudicial not only in respect to the illuminating powers of the combined gases, but they are also injurious in other respects. And it is for the purposes of purifying the gases from the sulphur and other impure products that gas-works have heretofore found it necessary to employ such extensive and expensive machinery and processes. In addition to the above objections, large quantities of tar, as well as of very offensive products, result from the present system of manufacturing gas from coal at gas-works, resulting in great waste in regard to the quality of good and pure illuminating gas a given weight of coal is capable of affording. According to this invention illuminating gas may be manufactured from coal and other bituminous mineral in such manner as to dispense with the use of the machinery and processes now necessary in gas-works for purifying the gases after they leave the retorts and before they arrive at the gasometers. It consists in so arranging gas-works as to employ in the manufacture of gas the hydro-carbon products of coal or other bituminous minerals, obtained by distilling such substances at a low temperature, whereby the patentee is enabled to dispense with the machinery and processes used for purifying illuminating gas, obtained by the existing process of destructive distillation of the bituminous mineral. For these purposes, cannel coal, parrot coal, boghead coal and other coal, and other mineral bituminous matters, are distilled at a low temperature, in such manner as to obtain the products in a condensed form in place of in the state of gases; then, when necessary, the resulting fluids are purified, and then such fluids are subjected to the action of heat in a finely divided state, in retorts or vessels to convert them into gas, which is conveyed into gasometers, such as were heretofore used at gas-works, in order that the same may be distributed therefrom, as heretofore practiced. Mr. Leslie prefers to use a cylindrical retort, heated externally by a fire, such retort being caused constantly to revolve slowly. Into this the coal or bituminous mineral is introduced, broken up into small pieces, and the products evolved pass off to the condensing apparatus, which is constantly kept cool by water, and the condensed hydro-carbon products are received into a suitable receiver or vessel. Care is to be taken to keep down the heat of the retort, in order to prevent the production of gases and vapors which will not condense —the object being to obtain only fluid hydro-carbons by the first process of distillation. When using the better classes of cannel coal the hydro-carbons obtained may at once be employed for the manufacture of gas; but when using hydro-carbons (obtained from less pure coal or bituminous mineral) which have nitrogenous and sulphur compounds combined therewith, these are purified in the following manner: — To remove the nitrogen the crude hydro-carbons are washed with dilute acid; dilute sulphuric acid will answer the purpose, but dilute muriatic acid is preferable, prepared by adding five gallons of water to one gallon of the concentrated muriatic acid of commerce; the hydro-carbons are then agitated violently with this diluted acid, using 15 gallons of diluted acid to every ton of the oil. The mixed hydro-carbons and acid is then allowed to stand for twelve hours, at a temperature of 90 degrees to 100 degrees Fahrenheit, and then the layer of acid liquor, which will have separated, must be drawn off. To free the hydro-carbons from sulphur compounds, the patentee uses at the rate of 1 ℔ caustic soda with one gallon of water, and from 14 to 30 gallons of such solution will be found sufficient to purify a ton of the hydro-carbon fluid. For this purpose the solution is well stirred into the hydro-carbons, and then allowed to settle for some hours, when the purified hydro-carbons may be readily drawn off from the impurities. In order to convert the hydro-carbon liquid into illuminating gas, it is caused to drop into a retort or vessel heated to a good red heat, and the gas is conveyed from the retort into gasometers of the ordinary construction, from which the illuminating gas is supplied to the gas mains, as gas has heretofore been supplied from gasometers. By these improvements not only will gas-works be rendered less objectionable in any neighborhood, but the gas obtained will be more pure, and the cost of production will be greatly reduced.

The second patent has principally for its object the purification of gas after it is manufactured. For these purposes, in distilling coal or other substances, the gas, instead of being conducted off from the upper part of the retort, and thence into the hydraulic main, is caused to descend from the retort, at the lower part thereof, into a chamber, and thence the gas is conducted off by a pipe at the upper part of the chamber to purifiers. Several retorts may be connected with the same chamber, in which case they each have a slide or valve to shut the entrance into the chamber. And in purifying gas, a solution of a salt of copper, preferring the sulphate, is employed to saturate wood shavings, or other porous material, through and amongst which the gas is caused to pass. The purifying matters thus employed are, from time to time, subjected to the passage of of atmospheric air amongst them to re-prepare them for the further purfication of gas therewith. By the kindness of the patentee, we have been enabled to witness some of the remarkable results which are obtained by these processes. A weighed quantity (2½ ℔s) of boghead coal was placed in a retort, which was kept slowly revolving over a fire, the temperature never approaching a red heat, and, indeed, scarcely reaching that of melting lead. The slow rotation of the retort preventing any one portion of the coal becoming hotter than the rest; the volatile constituents were all evolved in the liquid form, no gas whatever being produced. In a short time the 2½ lbs of coal had yielded in the receiver 1½ lbs of hydro-carbon fluid, leaving ¾ lb of coke in the retort. As soon as the liquid had ceased to come over, it was carried to an iron retort, which was kept at a red heat by means of a furnace, the arrangement being similar to that employed in gas-works. The 1½ pints of hydro-carbon fluid was then allowed to drop through a funnel tube into this red-hot retort, when the gas-holder which was in connection with it instantly began to rise, and within a minute and a half 25 feet of gas had come into the holder. The next day the luminosity of the gas, which we had seen prepared, was ascertained by means of a photometer. When burning at the rate

of *four feet* per hour, it equalled twenty sperm candles. The remarkable character of these results becomes more apparent if we calculate by the ton instead of the pound. A yield of 1½ pints for every 2½ lbs of coal, is equivalent to 168 gallons per ton of 2,240 lbs. Now 168 lbs is almost exactly one cubic yard; and calculating each gallon to produce, almost instantaneously, 128 cubic feet of gas, we have thus 21,504 cubic feet of gas from 168 gallons, the material for the production of which only occupying one cubic yard of space. Besides the greatly increased yield obtained by this process, there are other advantages which recommend it to the serious consideration of gas companies. By its means all the refuse coal which is now completely wasted at the pit's mouth, may be distilled into oil at the collieries. The liquid may be further purified from sulphur and other deleterious substances on the spot where it is made, whence it could be carried up to London, and converted into gas in the space of a few minutes. The advantages of this would be: the coal, being used at the pit's mouth, would cost a mere trifle; all the troublesome work of distillation and purification, with its concomitant evils of poisoning the neighborhood by the offensive odor, could be performed where labor was cheap and ground plentiful, instead of as at present in the heart of London; the expense of carriage of material to London would be considerably reduced, as only the real gas-making constituent of the coal would be transported; and, lastly, the complicated machinery of plant and hands, with the sickening odor with which it is always surrounded, would be in great measure done away with—no purifying apparatus would be needed—and the mehanical labor of converting any quantity of the hydro-carbon fluid into gas being reduced to the capacity of "a man and boy."—*Chemical News.*

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———(Sir Geo) Sobriety, a Letter on Asylums, 3rd edit., post 8vo	0	1	0	*Whittaker.*
Tourist's (The) Illustrated Handbook for Ireland, cr. 8vo., red. to	0	2	6	*Smith & Son.*
Veterinary Directory (The); or, Annual Register of Veterinary Surgeons, 1861, cr. 8vo	0	2	0	*Simpkin.*
Walsh (J. H.) (Stonehenge) and Lupton (I. J.) The Horse, in the Stable and the Field, 8vo	0	18	0	*Routledge.*

Miscellaneous.

How Straw Paper is made.

The art of manufacturing paper of straw has made rapid progress since its discovery. The paper was first made in this city in 1854. Although of a dingy yellow hue, harsh and brittle to the touch, and scarcely to be handled without tearing, its production was deemed the marvel of the age (as, indeed, it was), and the very least of the many glorious auguries of it was, that it should entirely revolutionize the newspaper business in time. In those days the straw was most unscientifically boiled in open tubs, and consequently it was never perfectly freed of its silica; and being silicated it was found almost impossible to wet it down for presswork, so that the paper was either too much printed, or not printed at all, and a growl went up from the reading public of alarm and indignation.

Under various mitigated forms, the evil, nevertheless, continued for years, and the growls grew fainter and fainter as the people's eyes and perverted tastes became accustomed to it.

About eighteen months ago letters patent were secured for various important modifications of the original process. The method of making straw paper is as follows:—

The straw is first passed into a cutter, whereby it is reduced to lengths of from three to four inches. It is then thrown into large vats, and thoroughly saturated with weak alkali. A most unpleasant odor hence arises, somewhat similar to that perceptible in all large breweries, but we are informed it is not prejudicial to the health of the workmen. This operation of mixing is termed "breaking down," and changes the straw in color to a dark biske. It is next filled into large air-tight boilers, fourteen feet in diameter, subjected to a pressure of steam ninety pounds to the square inch, and boiled in another alkali. Each of these boilers will contain eleven thousand pounds of broken straw. It is then ground into pulp, in the same method and by the same machinery that have hitherto been employed in the manufacture of rag paper. It has now been changed to a very dark slate color, and it would be difficult for us to recognize in it any element of the bright yellow straw of an hour since, if we were not previously acquainted with the marvelous nature of the transformation. After this it passes into a series of vats, where, by means of certain bleaching powders, it is brought to a hue of snowy whiteness, and reduced to a proper consistency by water. The mass now bears much resemblance to plaster-of-paris in solution, and is ready to be worked up into paper.

The most interesting process yet remains to be described, but we must pass into another apartment to witness it. At the eastern extremity of the room is a sort of trough, into which the pulpy liquor is pumped by steam power, and from which it flows upon a horizontal sieve of very fine copper wire. The fibres of the pulp at once arrange themselves on this sieve. A species of film is thus formed, which, though not a hundreth of an inch in thickness and largely saturated with water, has sufficient body to answer every purpose. It

is next made to pass between a series of wooden rollers, which gradually consolidate and compress its fibres and free it of all the surplus water. By means of heated rollers, through which it is caused to pass, every particle of moisture is at length removed, and it is calendered by being pressed between heavy polished iron rollers. The positions of two small revolving wheels, with cutting services, between which it is caused to move, regulate its width as required, and it is finally wound upon reels, from which it may be cut off into sheets of any length.

The entire operation is so simple that the visitor who has an opportunity of inspecting it cannot fail to comprehend it almost instantly. The machinery, nevertheless, requires to be of exceeding accuracy, and is accordingly rather expensive. Its capacity admits of the production of 9,000 pounds of paper per day, but only about three-fourths of that amount is at present manufactured, or between 180,000 and 190,000 pounds per month. Two thousand tons of straw are yearly consumed here in the manufacture of paper. But forty per cent. of this, however, is available as fibre. The balance passes off into glutinous matter and silica, neither of which being convertible into dollars and cents represents an appreciable value. This immense waste in the raw material is, however, fully compensated for in the advantages of the product. Compared with paper made from rags, straw paper has more body for the same weight, is better adapted for fast presses, and it will not readily tear, and calenders much more smoothly. As to whether it can be produced at a cheaper rate, we shall not take it upon ourselves to state. There are probably not over half a dozen factories in the United States engaged in making it. Two or three of them are situated in New York and another in Cincinnati. There is but one newspaper establishment in Philadelphia which uses straw paper for printing purposes.—*Philadelphia Press.*

Making Paper from Corn Leaves.

We translate the following from *L'Invention :—*

The conversion of the fibres of maize into paper is today an industrial fact confirmed by extensive success, and this discovery cannot fail to influence considerably the price of paper. This discovery, it is true, is not absolutely new ; in the Eighteenth century the manufacture was in operation in Italy with remarkable success; bnt, strange to say, the secret was kept by the inventor, and was lost at his death. Many attempts since made to revive the manufacture have all recoiled before the difficulty of removing from the leaves the silica and resinous matter which they contain, and which obstructs the conversion of the pulp into sheets. Happily, this secret has just been re-discovered, and not, as would have been anticipated, by a chemist, but by a simple Jewish writing-master—M. Moritz Diamant, an Austrian subject—to whom the new industry is going to give a considerable fortune. His process is applied at the present moment on a very large scale, at the imperial manufacture of Schlogelmühle, near Glonitz, in Lower Austria. Although the machinery of the establishment was constructed for working rags, and is not at all adapted to the kind of preparation that corn leaves require, the essay that has been made has had a prodigious success ; the paper obtained leaves nothing to be desired in strength, homogeniety, polish and whiteness. In the last point, particularly, the sheet from corn surpasses that from rags, which always contain impurities that can be removed only with great difficulty.

It is Count Carl de Lippe Veissenfeld who operates at this moment the discovery of M. Moritz Diamant, interested, as may well be supposed, in the fabrication of paper from maize.

According to the German Journal from which we have borrowed the preceding details, the principal advantages of this manufacture are the following :—

1. It is not solely possible to produce from the leaves of maize all the species of paper manufactured at this day ; but it happens, furthermore, that in several respects this paper is superior to that made from rags.
2. But little starch is required to prepare the paper for receiving writing, which results from the fact that the corn leaves already contain a natural ingredient that takes the place of starch. This ingredient may be easily removed if desired.
3. The bleaching of this paper is effected almost instantaneously by a process the most simple and the most efficacious. It is, furthermore, only feebly colored, and for wrapping paper, bleaching is entirely unnecessary.
4. The paper from maize is stronger—more tenacious—than the best paper made from rags. There is none of the fragility which characterizes paper into the composition of which ordinary straw enters—a fragility which is principally due to the abundance of silica contained in straw.
5. In the process invented by M. Moritz Diamant, no species of machine being necessary to convert the fibers of maize into paper pulp, and this conversion being made by means entirely different from those employed in working rags, there results a great simplification in the apparatus, and consequently a notable reduction in the manual labor and the expense of the manufacture.—*Scientific American.*

British Wool.

Mr. Caird, M.P. (of Michigan Central Railroad notoriety), read at a recent meeting of the Council of the Royal Agricultural Society of England, a paper upon British wool. He remarked that, although there had been an immense increase in the importation from foreign countries and the colonies during the last twenty years, the rearing of sheep for the production of British wool continued to be one of the most profitable branches of our industry. Within the period referred to there had been, no doubt, in the imports from Spain and Germany, a diminution of about 4,000,000 pounds ; but at the same time, to compensate for this, there had been an increase from Russia, the Low Countries, Denmark and Portugal, of no less than 20,000,000 pounds. There had been an increase within this period, in round numbers, from Australia, of from 13,000,000 pounds to 54,000,000 lbs. ; from South Africa, of from 1,000,000 pounds to 14,000,000 pounds ; from the East Indies, of from 4,000,000 pounds to 14,000,000 pounds. At home the increase in the amount of wool produced was equally remarkable. In 1842 the home-grown wool did not exceed 100,000,000 pounds; it now amounted to 120,000,000 pounds. There had been, in short, an augmented supply of wool to the extent of nearly 75 per cent. It had not been followed by any diminution of price to the home producer. Now, the countries in which the production of wool is likely to increase most rapidly, viz., Australia, the East Indies, South Africa and South America, are all unsuitable to the production of the lustrous long wools, for which there is a great demand. The British Islands supply this wool in the greatest quantity. They may be almost said to have a monopoly of it, and there are no countries which can enter into competition with them. Mr. Caird is, therefore, of opinion that the British wool-grower should develope its production as much as possible, and he thinks the supply may be increased by good farming and liberal feeding. The best cross that could at present be adopted on suitable soils would, he adds, be obtained by using the improved Lincoln or Leicester ram, in which the desirable qualities of length, lustre, strength and fineness of wool seemed to be best combined.

Portland Breakwater.

An immense breakwater has just been completed at Portland, on the southern coast of England. The whole work was done by convict labor. It is described as a mole of loose stones, three hundred feet in breadth at the base, one hundred feet in height, and a mile and a half in length. It has cost, in round numbers, £900,000, twice the estimated expense. At the end of mole a first-class fortress will be built.

French Beet-Root Sugar.

According to an official return just published in France, concerning the manufacture of beet-root sugar from the commencement of the season 1860–'61 to the and of the month of April, it appears that the number of establishments in activity were 334, being four more than in the corresponding period of the preceding year. The number of manufactories not at work, but having sugar still in stock, had diminished from twenty-four to fifteen. The quantity made was 97,900,000 kilogrammes, being 27,000,000 less than in the corresponding period of 1860. The quantity delivered for consumption had increased from 6,000,000 to 18,500,000 kilogrammes.

To Remove Ink from Paper, &c.

The process of thoroughly extracting all traces of writing-ink, whether accidentally spilt or written in error, is to alternately wash the paper with a camel hair brush dipped in a solution of cyanuret of potassium and oxalic acid; then when the ink has disappeared, to wash the paper with pure water. By this process cheques have been altered when written on "patent cheque paper," upon which it was supposed by a recent inventor to be impossible to remove writing.—*Septimus Piesse.*

The Separation of Crystallizable from Non-Crystallizable Substances.

The eminent chemist, Graham, Master of the Mint, recently read a paper before the Royal Society in London, on a new mode of separating substances like sugar and salt, which will crystallize, from those such as gum, which will not. Mr. Graham calls the class that will crystallize *crystalloids*, and those that will not, *calloids.*

The *crystalloids* in solution are free from gumminess or viscosity, and are always sapid or have a positive taste.

The solution of *colloids* has always a certain degree of viscosity, and they are insipid or wholly tasteless. Starch, the vegetable gums, tannin, albumen and vegetable and animal extractive matters belong to the class of colloids.

Mr. Graham finds that these two classes of substances may be separated from each other by the mysterious operation of osmose. He constructs a vessel in the form of a seive with a flat hoop of gutta percha and a bottom of animal membrane, like bladder, or of the paper called "vegetable parchment," and pours the solution containing the mixture of the crystalloid and colloid into the vessel to the depth of half an inch, and then floats the vessel on the surface of water. The crystalloid passes down through the membrane by osmose, and the colloid remains. Mr. Graham gives to this mode of separation the very appropriate name of *dialysis.*—*Scientific American.*

The Domes at the Great Exhibition Building.

On the 26th August, the first of the columns which are to support these giant domes was put up, and the contractors undertake to have all complete within six months. The highest portion of these domes will soar some 16 ft. above the Monument of the Fire of London, and persons standing upon the ground within the building will have to cast their eyes up to a height of 180 ft. or 16 ft. higher than the great transept of the Crystal Palace at Sydenham, to reach the under side of these great globes. Wide as is the span of that great transept, it is 80 feet less than that which will be covered by the dome at Kensington. Each of these domes will be supported by eight cast iron columns, 2 feet in diameter, perfectly round, and without any rib, outer projection, or ornament. They will rise to the height of 108 feet, the upper part being of the same diameter as the lower. Each one of these columns will be formed of five separate lengths, joined together by bolts passing through flanges cast on the inside, so that, when completed, the parts where they are joined will not be perceptible, and will have the appearance of an enormous mast, without, however, its tapering end.

Mineral Wealth of Britain.

Eighty million tons of coal are consumed and exported annually in England. 8,000,000 tons of iron ore are raised, producing 3,826,000 tons of pig iron. Of copper ore 15,968 tons are raised in England, which yield 15,968 tons of metallic copper. The total annual value of British minerals and coals is estimated at £26,993,573 sterling, and of the metals or produce of the minerals £37,121,318 sterling.

Ocean Telegraphs.

The tabular statement of the Committee appointed to report on Ocean Telegraphs shows that at the present time 11,364 miles have been laid, but of these little over 3,000 miles are actually working.

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative wood cuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor wlll exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURES & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.

THE JOURNAL

OF THE

Board of Arts and Manufactures

FOR UPPER CANADA.

DECEMBER, 1861.

INTERNATIONAL EXHIBITION, LONDON, 1862.

COMMISSIONERS FOR CANADA:

Sir W. E. Logan, F.R.S., (Director of the Geological Survey) Chairman.

The Hon. L. V. Sicotte, M.P.P., St. Hyacinthe, (President Lower Canada Board of Agriculture).

Col. Thompson, Toronto, (President Upper Canada Board of Agriculture).

J. Beatty, Jr., M.D., Cobourg, (President Upper Canada Board of Arts and Manufactures).

J. C. Tachè, Esq., M.D., Quebec.

B. Chamberlin, Esq., B.C.L., Montreal (Secretary Lower Canada Board of Arts and Manufactures).

J. B. Hurlburt, Esq., LL.D., Hamilton.

(CIRCULAR.)

"QUEBEC, 15th November, 1861.

"The Provincial Commissioners appointed to secure a representation of Canadian products in the International Exhibition, to be held in London in the summer of 1862, take the earliest opportunity to make known to the public that they have this day been informed that the sum of $6,000 has been placed at their disposal by the Provincial Government for that purpose. They are authorized, out of this sum, to pay for the freight and charges on all articles approved by the Commissioners for transmission to London, but are not authorized to purchase any manufactured products.

"Parties desirous of exhibiting articles of Canadian produce will please make application (post paid) to the Commissioners through me, on or before Wednesday the fourth day of December next.

"Articles intended for exhibition must be prepared to be sent in, on or before the 25th day of February next, to places, hereafter to be determined upon, of which public notice will be given.

"The Commissioners venture to hope that the public spirit of manufacturers and other producers will induce their general co-operation in the endeavour of the Commission to procure a representation as complete as possible, of the varied products of Canadian Resources and Industry in the forthcoming great Industrial Exhibition of all nations. Wherever it is deemed desirable and advantageous the Commissioners will gladly avail themselves of the asistance of Local Committees."

B. CHAMBERLIN, Comr.,
Secretary.

The circular of the Commissioners will scarcely reach some intending exhibitors in time for them to make application before the fourth day of the present month. This limitation in point of time is not the fault of the Commissioners, for they state that they "have this day (15th November) been informed that the sum of $6,000 has been placed at their disposal by the Provincial Government," and it is very important that the Commissioners should be made acquainted with the various demands for space at the earliest possible date.

The circumstances under which we now draw attention to the representation of Canadian industry at the International Exhibition of 1862, are very different from those which existed when the Committee of the Board of Arts and Manufactures for Upper Canada made their report on this subject on the 14th March. Time for preparation and collection was considered by the Board as the most important element for securing a fair representation of Canadian Productions and Industry.

"The Committee understand it to be the desire of the Board, in thus early adopting measures to facilitate the representation of our civilization, industry and resources at the Exhibition of 1862, before the action of the government or the amount of aid available is made known, to obviate as far as possible the difficulties and disadvantages which were felt previous to former exhibitions, on account of the short notice which was given to exhibitors, that the display would partake of a provincial character, and that aid would be supplied by a public grant.

"A moment's reflection will suffice to show that if an entire year is not devoted to the collection of some of our natural productions, especially those of the vegetable kingdom, the representation will be incomplete, and therefore, to a certain extent, valueless, as the season in which many necessary specimens are best developed will soon pass away."*

It is to be hoped that many intending Exhibitors have so far adopted the views of the Committee as to have advanced their preparations without waiting for the announcement that a grant to defray necessary expenses would be made. But the time for making application for space to display their productions is, it must be acknowledged, lamentably short. It is not improbable that, from the wording of the circular, many parties will apply for *permission to exhibit* instead of *for space*, so that additional correspondence will ensue; and if the number of applicants should be equal to those of 1855, the office of Secretary to the Commission will be no sinecure.

The number of Exhibitors in 1855 was three hundred and twenty-one. The correspondence involved in replying to the demands, queries, doubts, &c., of

* Report of the Committee to draft a series of suggestions in relation to the International Exhibition of 1862, page 95 of this *Journal.*

so many anxious applicants, crowded into a few weeks, will be no ordinary task. The Commission state that, wherever it is deemed desirable and advantageous, they will gladly avail themselves of the assistance of local committees. Unfortunately there does not appear to be *time* for the organization and action of such committees. Before they could communicate with producers and manufacturers, the 4th of December would have passed away; of this the Commissioners are evidently aware, or they would have pressed the point deemed so important in the preparations made for the Paris Exhibition of 1855.

In the preliminary report of the Sub-Committee appointed by the Provincial Committee in 1855, the following paragraphs occur:

"After much consideration and discussion, they have arrived at the conclusions—

"That it is absolutely necessary, in order to secure the end desired, that authority should be given to the Provincial Committee *to purchase such articles as they deem essential to that object.* They are of opinion that any *attempt to induce voluntary effort by means of local Fairs would be fruitless.* The experience of all who were actively engaged in promoting the Canadian Exhibition at the World's Fair in London in 1851, is, that the success of the present effort must depend entirely upon the energy and judgment to be displayed by an efficient Executive to be appointed by the Commissioners.

"They would recommend that the Provincial Committee should delegate their powers to an Executive Committee, to be composed of twenty-one members, fifteen of whom should be in a position to give their attendance at Quebec; two should be resident at or near Montreal, the remainder to be gentlemen specially connected with the industrial resources of Upper Canada."

The Commissioners for the forthcoming Exhibition are in a totally different position to that of their predecessors in 1855. They have no money *to purchase* manufactured articles to be sent to London, they are consequently cut off from the only hope which the Committee of 1855 possessed of despatching to Paris a fair representation of our industry. One would almost suppose, from the wording of the circular, that the present Commissioners did not entertain very sanguine expectations respecting their mission to "*secure* a representation of Canadian products at the International Exhibition," for they only "*venture to hope* that the public spirit of manufacturers and other producers will induce their general coöperation." In the face of the "absolute necessity" for purchasing articles which the Committee for 1855 were governed by, backed by the experience of 1851, the present Commissioners can only fairly express "a hope" that they will receive active coöperation; but we trust that that hope will soon be transformed into a certainty, and that public spirit as well as private sense of honourable distinction will induce our manufacturers and artizans to exert themselves, in order that the reputation of Canada may be upheld. Knowing, as every one must know, that Canada has made remarkable progress since 1851, it will be galling, indeed, if the criticism upon our appearance in London should imply that we have retrograded, or are become indifferent, or too poor, or too much involved, to make a creditable appearance on the great Exhibition ground of the World. The Board of Arts and Manufactures for Upper Canada will no doubt take all the measures which lie within their power to stimulate manufacturers and artizans to send the productions of their industry and skill, but it is clear that they can do little or nothing before the 4th of December; and without the Commissioners consent to an extension of time during which they will receive applications, little can be done.

Many persons we think take too narrow a view of the advantages which might accrue to Canada if well represented at London. It is not unfrequently urged that it is absurd to send Canadian manufactures to be placed side by side with the highly finished and cheap productions of the skill and capital of Britain or France. We grant willingly that it would be absurd to put them in competition, but it would be wise to display what we have done and can do, in order to advertise the country and call the attention of intending emigrants to its capabilities and the *field for enterprise* which it presents. However meagre may be the display of our manufactured articles by comparison, in such an arena, it will serve the purpose of directing attention to Exhibitors, advertising their goods, and having Canada mentioned continually in the newspapers, periodicals and reports published in Europe. People do not look for such results here as are only attained where capital is abundant, and where skilled labour is cheap. But they would be gratified to find that in this "distant Colony" all the necessaries and many of the luxuries of life are easily and cheaply procured, and that a boundless field is open to their enterprise. A Canadian piano for example, such as was lately exhibited at London, C.W., of Canadian manufacture, down to the most insignificant piece of ironwork, would produce a favourable effect as an advertisement for the whole country, because it is one of those articles which imply taste to appreciate and skill to produce; such as many a penny-a-liner would delight to enlarge upon, and probably take as a text for a wordy column on "Art in the Backwoods of Canada." We want the well to do emigrant classes of the people of Great Britain and Ireland to *see* something from Canada, to know that the two millions and a half of their fellow subjects on this side of the Atlantic are as full of enterprise and

ingenuity as themselves, and that in two generations they have not only converted a boundless forest into innumerable fruitful farms, but that their cities and towns all contain the germs of that wonderful industry and skill which has made Britain so powerful, so rich, and so great. Every one feels pleased and gratified at the favourable notices of the press upon our former displays at London and Paris. The regrets of the French at the loss of so fine a colony, whose value they only found out in 1855, were at least flattering, and contained the germ of future commercial advantages. On the same ground is every one disgusted at the ignorance not unfrequently displayed in Europe respecting our resources, climate, and geography.

The remedy is apparent. Make the country known, send the products of your industry to be seen by all, give date, price, cost of material, and every information respecting them, and the knowledge of the resources and civilization of the country will soon spread and be attended with profit to all.

Sir William Logan, the Chairman of the Board of Commissioners, has we understand already despatched into the field a body of competent and active collectors, to bring together an entirely new representation of Canadian mineral productions. Sir William enjoys this great advantage, that he knows exactly where his mineral treasures lie, and he has only to give directions, despatch messengers, and collect his specimens.

Sir William Logan has another qualification which is not so widely known, he does not spare his own private purse in the execution of a public object. Many persons have long been aware that the expenses of the geological survey exceed the annual grant, but it is not so generally known that the additional expenses have hitherto come from the private purse of the distinguished Director of the Geological Survey of Canada. We have no fear that the mineral wealth of this Province will be inefficiently represented, although no portion of the $6,000 grant will go to pay the extraordinary expenses of the Commissioner, and the time for collecting specimens is very limited. We hope that the manufacturing industry of the Province will find equally public spirited men, according to their means, to secure its representation, and that the question, often unfairly asked in a narrow spirit of selfishness, "will it pay?" will receive a manly and patriotic response in the affirmative, with a proper understanding of the advantages to the country at large which a just representation of "Canadian resources and industry" is certain to produce.

When his Royal Highness the Prince of Wales passed through Western Canada, the country people assembled at the railway stations to see the illustrious visitor, frequently gave utterance to such expressions as the following: "What a sight of money this trip will cost him!" "What can he be coming here for?" "*How can it pay him?*" all tending to show an entire want of thought or knowledge respecting the motives which governed their illustrious visitor, the position he occupied as the representative of the Queen, and the relation which they would some day bear to him. These same suspicious spectators, always accustomed until then to estimate the actions of a man by the money he was going to make, when they heard that the Prince had passed through the United States with equal eclat and expense, and then gone quietly home to resume his studies again, began to receive new impressions of mankind and of the motives which rule in the breasts of a few. They found that it was possible for men to be unselfish as far as money was concerned; that such a thing as a spirit of public good did exist, not necessarily associated with dreams of remuneration; and that there were men who could devote their time, and, what was infinitely more, their hard cash, to the happiness and welfare of their fellow creatures. This enlarged view has happily rooted out many narrow minded and selfish errors of defective early training, or a want of civilized education, now rapidly spreading through the country; and it may be boldly asserted that in no way has the Prince's visit proved so beneficial to Canada, especially at the present juncture, than in the loyal feeling it has created among the backwood farmers, who admire to excess charity, patriotism, glitter and pageantry, when it costs them nothing, and are both astonished and delighted that they have seen one who sets a splendid example of all, and never dreams of asking "Will it pay?"

It is a pleasant task to record the names of those who did honour to Canada in 1851 and 1855, by winning Medals, Prizes, and Honourable Mention, in the magnificent scenes of friendly rivalry at London and Paris. It would indeed be gratifying to find that the experience of the Committee of 1855 did not apply to the people of Canada in 1862; that it will not be "absolutely necessary" to purchase illustrations of our industry, in order to prove that we contain the true elements of civilization; and that we do not all require the stimulus of a few dollars and cents to warm our torpid love of country into a healthy and vigorous glow.

Although the time is short, yet, if the Commissioners consent to receive applications for space until the close of December, much may yet be done by the Boards of Arts and Manufactures, Mechanics' Institutes, and private individuals, and if ordinary zeal is shown we are far from despairing of our representation in London next year. Under all circumstances, it is the duty of every one to give the Commissioners the best assistance in their power, and

we sincerely hope that they will meet with active coöperation in every department, and that many future pages of this journal may be filled with a recital of the successes of our countrymen, together with a long list of names, like those given below, which will always remain a credit and honour to their country in connection with the representations of Canadian civilization and resources at London and Paris.

EXHIBITION OF 1851.

The following table contains the names of the Exhibitors who received prizes, medals, and honourable mention at the London Exhibition in 1851:—

Class I.

Mining, Quarrying, Metallurgical Operations, and Mineral Products.

PRIZE MEDAL.

Ferrier, Hon. J. .... Quality of Iron.
Montreal Mining Co.......... Copper Manufacture.

HONOURABLE MENTION.

Chaudière Mining Co........ Native Gold.
Logan, W. E. .... Manganese and Iron Ores.
Marmora Iron Company..... Iron, &c.
Wilson, Dr. J.................. Magnetic Iron Ores.

Class II.

Chemical and Pharmaceutical Processes and Products generally.

No prizes awarded to Canada in this class.

Class III.

Substances used as Food.

PRIZE MEDAL.

Christie, D...................... White Wheat.
Fisher, Arthur................. Maple Sugar.
Jones, D......................... White Peas.
Limoges, D...................... White Peas.
Reinhardt, G................... Ham.
Robb, J. .... Biscuits.
Simpson, J., & Co............ Wheat Flour.
Squair, R. .... Oatmeal.
Watts, R. M. .... Polish Oats.

HONOURABLE MENTION.

Bales, J. .... Maple Sugar.
Bucke, R. .... Arrowroot.
Davies, Thomas, & Sons .... Hops.
Fisher, J......................... Seeds of Cameline.
Gillespie & Co. .... Wood Vinegar.
Jeffries, G. .... Clover Seed.
Levey, J.......................... Tobacco for Cigar making.
MacGinn, T. .... Timothy Grass Seed.
Trenholme, E.................. Buckwheat and its Flour.

Class IV.

Vegetable and Animal substances chiefly used in Manufactures, Implements, or for Ornament.

PRIZE MEDAL.

Montreal Centr'l Commission Collection of Woods.
Reed and Meakins............ Hard Woods.

HONOURABLE MENTION.

Allon, J. .... Tannery substances.
Bastein, M. .... Flax.
Brunsden and Shipton....... Starch.
Egan, J. .... Woods.
Fisher, J......................... Woods.
Grice, F.......................... Flax.
Hewson, J....................... Woods.
Tètû, C, A....................... Fish Oils (Porpoise).
Mackay & Co.................. Silk.
Parisault, J..................... Woods.
Prendergast.................... Gums, &c.

Class V.

Machines for direct use, including Carriages and Railway and Naval Mechanism.

PRIZE MEDAL.

Perry, G., & Brothers........ Fire Engine.

Class VI.

Manufacturing Machines and Tools.

No awards in this class to Canada.

Class VII.

Civil Engineering, Architecture, and Building contrivances.

No awards in this class to Canada.

Class IX.

Agricultural and Horticultural Machines and Implem'ts.

No awards to Canada.

Class X.

Philosophical Instruments and Processes depending upon their use, Musical, Horological and Surgical Instruments.

Higgins, P.......The quality and cheapness of a Violin.

Class XI.

Cotton.

No award in this class to Canada.

Class XII.

Woollen and Worsted.

Gamble, W...................... Blankets.

Class XIII.

Silk and Velvet.

No award in this class to Canada.

Class XIV.

Manufactures from Flax and Hemp.

No award in this class to Canada.

Class XV.

Mixed Fabrics, including Shawls, but exclusive of Worsted Goods.

No award in this class to Canada.

Class XVI.

Leather, including Saddlery and Harness, Skins, Fur Leathers, and Hair.

PRIZE MEDAL.

Tètû, C. A. .... Curried Porpoise Leather and samples of Leather from the skin of a Whale.
Morris, R. .... A set of double Sl. Harness

HONOURABLE MENTION.

Henderson J. .... Sleigh Robes & other Furs.
Stewart, W.................... A set of sing. Sl. Harness.

CLASS XVII.

Paper and Stationery, Printing and Bookbinding.
No award.

CLASS XVIII.

Woven, Spun, Felt and Laid Fabrics, when shown as specimens of Printing or Dyeing,
No award in this class to Canada.

CLASS XIX.

Tapestry, including Carpets and Floor Cloths, Lace and Embroidery, Fancy and Industrial Works.
No award in this class to Canada.

CLASS XX.

Articles of Clothing for immediate personal or domestic use.

HONOURABLE MENTION.

Adams. W. H. F............. Cloth made up into coats.
Barbeau, T.................... Deer Skin Boots.

CLASS XXI.

Cutlery and Edge Tools.

HONOURABLE MENTION.

Ladd, C. P...................... Axes.
Leavin, G. .... Axes.
Scott & Glasford................ Axes.
Shaw, Samuel.................. Axes.
Wallace, A....................... Planes.

CLASS XXII.

Iron and general Hardware.
Cheney, G. H.................... Stoves.
Ladd, C. P. .... Balance Scale.
Rice, W. .... Wire Fencing.

CLASS XXIII.

Working in precious metals and in their imitations, Jewelery, &c.
No award in this class to Canada.

CLASS XXIV.

Glass.
No award in this class to Canada.

CLASS XXV.

Ceramic Manufactures, China, Porcelain, Earthenware, &c.
No award in this class to Canada.

CLASS XXVI.

Decorative Furniture and Upholstery, &c.
No award in this class to Canada.

CLASS XXVII.

Manufacture in Mineral substances, &c.

HONOURABLE MENTION.

Hammond, R................. A polished stone table.

CLASS XXVIII.

Manufactures from Animal and Vegetable substances, not being woven or felted.

PRIZE MEDAL.

Baily, J. .... Pails.
Dunn, W......................... Chair, Porcupine Quill.
Marshall, R. .... Dinner Mats.

HONOURABLE MENTION.

Nelson & Butters. .... Brooms.

CLASS XXIX.

Miscellaneous manufactures.
Henderson .... Clay Pipes.

CLASS XXX.

Sculpture, Models, and Plaster Art.
No award in this class to Canada.

The remarks of the jurors on the Canadian Department were most flattering, and although often published, may with propriety at the present period be again brought under the notice of our readers.

"Of all the British Colonies, Canada is that whose exhibition is the most interesting and the most complete, and one may even say that is is superior, so far as the mineral kingdom is concerned, to all countries that have forwarded their products to the Exhibition. This arises from the fact that the collection has been made in a systematic manner, and it results that the study of it furnishes the means of appreciating at once the geological structure and the mineral resources of Canada. It is to Mr. W. E. Logan, one of the members of the Jury, who fills the office of Geological Surveyor of Canada, that we are indebted for this collection; and its value arises from the fact, that he has selected on the spot most of the specimens that have been sent to the Exhibition, and has arranged them since their arrival in London. The arrangement that he has adopted, which is entirely technical, includes eight divisions, viz:—Metalliferous minerals, and metals obtained from them; Minerals which require complicated operations to render them fit for use; Lithographic limestones and minerals employed in Jewelery, and in the manufacture of glass of various kinds; Various kinds of clays and refractory sandstones; Rocks furnishing whetstones, hones, and polishing stones; Rocks and minerals in use for improving soils; Materials used in construction, and rocks serving for architectural decoration; Combustible materials. All these classes include materials, of great interest, for industrial purposes, and we think it useful to mention some more specially. The ores of iron require notice first of all for their abundance and excellent quality, as the magnetic oxide is worked in upwards of ten different localities. The mines of Marmora, the most important of all, are situated in the west of Canada, and are worked in a mass of ore more than 100 feet thick. The magnetic ores obtained from them are accompanied by pig iron from the works established on the spot, and belonging to the Marmora Iron Company. The Jury has recognized the good quality of their products by making honourable mention of this Company; and the same is awarded to Dr. J. Wilson who has exhibited magnetic iron ores from South Sherbrooke, and phosphate of

lime from Burgess. Ordinary mention has also been made of Mr. Lancaster of Vaudreuil, Captain Morin of St. Vallier, Messrs L. Seer of Eustache, E. Caron of St. Ann, Montmorency, G. Duberger of Murray Bay, and R. W. Kelly of Gaspé, who have exhibited ores of iron and iron ochres of different kinds. Massive hydrous oxide of iron is an important mineral amongst the iron ores of Canada, and is workable in large masses in several localities. We may mention, particularly, that of St. Maurice, which for more than half a century has supplied the iron works and founderies of that name. The Honourable J. Ferrier, the proprietor of the mines, whose products are exhibited in. No 5, has added to the ores, specimens of pig and other iron, besides slags and ashes obtained during the working of the ores. The iron from St. Maurice is of good quality and the products exhibited show that the establishment proceeds with regularity, in a metallurgical point of view; these considerations have induced the Jury to award a Prize Medal to the proprietor. The exhibition of Canada includes the ores of zinc, lead and copper, from several localities. The ores of copper from Lake Superior and Lake Huron are remarkable for their richness, and that called "Bruce Mine" on Lake Huron has been worked for some years. The Mining Company of Montreal (the proprietors of this mine,) have erected an establishment for working the ores on the spot, according to the methods adopted at Swansea, and the objects sent by this Company exhibit by the side of the ores the various products of smelting, besides the specimens of black and refined copper. Specimens of copper and native silver, from the Island of St. Ignatius, on Lake Superior, are added to these, and the Jury has awarded to the Company a Prize Medal for these various objects. The existence of spangles and pepites of Gold have been proved by actual investigation, in several rivers in the East of Canada, and honourable mention is made of the Chaudière Mining Company who exhibit pepites of native gold collected in the washing of those streams. Messrs. Bodin & Lebert are also rewarded with a mention for the white quartzose sands which they exhibit, which are used with advantage in the manufacture of flint and crown glass. The last award that we have to mention in the case of Canada is the honourable mention adjudged to Mr. Logan who has exhibited iron ores, lithographic stones, minerals, and various rocks. Our colleague has not thought it right to add to these the geological map he has made of Canada, a matter which the Jury greatly regret, not because they would then have been able to adjudge a reward for this beautiful work,—for the position of Mr. Logan, as member of the Jury, would render this impossible,—but because of the great interest it would have added to the Canada Exhibition. The lithographic stones exhibited by Mr. Logan belong to a paleozoic rock, occuring at Marmora, where the magnetic iron ore has been mentioned as forming a deposit of enormous thickness. These stones are remarkably homogenous, and fine grained; the degree of finish of the drawings that Mr. Logan has caused to be made upon them giving every promise of the quality being good. The geological position of the stones is interesting, and the reporter is not aware of such material having been previously found in the old rocks, since up to the present time those who practice lithography seek for stones from rocks of the oolitic series. The discovery of Mr. Logan proving that the palæozoic rocks may also furnish good lithographic stones, increases the resources available for this important branch of engraving and drawing."

It is very gratifying to be able to state upon excellent authority that Sir William Logan's Geological Map of Canada will be published in time for the Exhibition at London, and also that a description of the Geology of Canada will accompany this long expected, long looked for map.

EXHIBITION OF 1855.

The following table contains the names of Exhibitors who obtained Prizes and Honourable Mention at the Paris Exhibition in 1855.

First Class

Mining and metallurgy, comprising general statistics, the modes of working mines, the modes of preparing metals, coals and combustible minerals, iron, common metals, precious metals, coins and medals, non-metallic mineral productions.

GRAND MEDAL OF HONOUR.

The Grand Medal of Honour was awarded to Sir William Logan, for his Geological Map of Canada, and as exhibitor of the greater part of the collection of minerals.

Second Class.

Everything relating to the management of trees, or to sporting fishing and hunting, and products obtained without cultivation, comprising statistics and general documents, management of the trees, hunting of terrestrial and amphibious animals, fishing, products obtained without cultivation, destruction of vermin, means used for acclimatizing animals and plants.

A Medal of Honour was awarded to the Government of Canada for all the collection of the class, and of the following class which belongs to the same group.

A first class Medal to the Hudson Bay Company for a collection of furs.

A first class Medal to Mr. Andrew Dickson, of Kingston, for a collection of timber.

A second class Medal to Messrs. Farmer and DeBlaquiere, of Woodstock, exhibitors of a collection of timber.

A second class Medal to Mr. Sharples, of Quebec, for exhibiting a collection of timber.

Third Class.

Agriculture, comprising Statistics and General Documents, Farming, Agricultural Tools and Implements, General Produce, Special Produce, Rearing of Useful

Animals, Industries immediately connected with Agriculture.

FIRST CLASS MEDALS.

Mr. Cross of Montreal, for cheese.
Canada Company, Toronto, for wheat.
Lyman & Co., Montreal, for seeds.
Mr. Shaw, Toronto, for chicory.
Mr. Perry, Montreal, mechanic.

SECOND CLASS MEDALS.

Mr. Fisher, of Montreal, for seeds.
Mr. Fleming, of Toronto, for seeds.
Mr. Laurent, of Varennes, for oats.
Mr. Morse, of Milton, for a plough.
Mr. Shaw, of Toronto, for seeds.
Mr. Sheppard, of Montreal, for a collection of seeds.
Mr. Wade, of Cobourg, for seeds.

HONOURABLE MENTION.

Mr. Coffin, of Gaspe, for wheat.
Mr. Evans, of Montreal, for seeds.
Mr. Kempton, of Ste. Therese, for seeds.
Mr. Jarvis, Toronto, for hops.
Rev. Mr. Villeneuve, Montreal, for wheat and peas.

FOURTH CLASS.

Machinery in general, as applied to industry, apparatus for weighing and guaging, instruments used for conveying power and detailed portions of machinery, horse gins, windmills, hydraulic machines, steam engines and air engines, machines used in moving heavy weights, hydraulic engines for lifting, ventilators and bellows.

FIRST CLASS MEDAL.

Mr. George Perry, of Montreal, for a fire engine.

HONOURABLE MENTION.

Mr. Lemoine, of Quebec, for a fire engine.

FIFTH CLASS.

Special machinery and apparatus for railways and other modes of transport, comprising apparatus for carrying burdens on the arm, the back, or the head, specimens of harness and saddlery, materials and apparatus for wheelwright's work and carriage making, carriages, railway apparatus for water conveyance, air balloons.

HONOURABLE MENTION.

Mr. Barrington, of Montreal, for a harness.

SIXTH CLASS.

Special machinery and apparatus for workshops, comprising separate pieces of machinery and apparatus for workshops, machines used in mining operations, machinery used in building, machines for working non-metallic minerals, metallurgic machines, apparatus and mechanical contrivances used in workshops, machines used in the manufacture of small articles in metal, machines used in the felling of trees and in their after treatment, machinery used in agriculture and in the preparation of alimentary substances, machines used in the chemical arts, machines used in connection with dyeing and printing, machines used only in certain trades.

FIRST CLASS MEDAL.

Mr. Rodden, of Montreal, for a machine for carpenters' work.

SECOND CLASS MEDAL.

Mr. Munro, of Montreal, for a planing and grooving machine.
Mr. Paige, of Montreal, for a large threshing machine.

HONOURABLE MENTION.

Mr. Dunn, of Montreal, a nail making machine.
Mr. Rice, of Montreal, a sifting machine.
Messrs. Dion & Lepage, Rimouski, a model of a threshing machine.

SEVENTH CLASS.

Special machinery and apparatus for the manufacture of woven fabrics, comprising instruments used in spinning and weaving, machines used in the preparation and spinning of cotton, machines used in the preparation and spinning of flax and hemp, machines used in the preparation and spinning of wool, machines used in the preparation and spinning of silk, rope making, lace making and special machines, weaving of the low warp and high warp, looms for making hosiery, apparatus and machinery for bleaching, dyeing, dressing, and the folding of fabrics.

No Prizes to Canada in this Class.

EIGHTH CLASS.

Arts relating to the exact sciences and to instruction, comprising standard weights and measures, documents of all kinds relating to the different weights and measures used in each country, clock work, optical instruments and apparatus of all kinds used in measuring space, instruments employed in the study of physics, chemistry and meteorology, maps, models and documents relating to astronomy, geography, topography and statistics, apparatus used in the study of the sciences, materials for elementary instruction.

No Prizes to Canada in this Class.

NINTH CLASS.

Manufactures relating to the economical production and employment of heat, light and electricity, comprising processes having for their object the employment of heat, cold, light and electricity derived from natural sources, processes having for their object the production of fire and light, combustibles to be used as cheap fuel, warming and ventilation of houses, production and employment of heat and cold in domestic economy, production and use of heat and cold in the arts, lighting, lighthouses, signals and ærial telegraphs, production and employment of electricity.

SECOND CLASS MEDAL.

Mr. Rodden, of Montreal, for a cooking stove.

TENTH CLASS.

Chemical manufactures, dyeing and printing, paper, leather, skins, india rubber, comprising chemical products, fatty substances, rosins, scents, soaps, varnishes and all kinds of coatings, india rubber and gutta percha, paper and paste-board, bleaching, dyeing, printing,

colors, inks and pencils, tobacco, opiums and various narcotics.

No Prizes to Canada in this Class.

ELEVENTH CLASS.

Preparation and preservation of alimentary substances comprising flour, fecula and their extracts, sugar and sweet substances, fermented drinks, preserves and condiments, preparations from cocoa, coffee, tea, &c., confectionary and products of distillation, apparatus and processes for the preparation of food.

SECOND CLASS MEDALS.

Government of Canada for the Canadian collection.
Mr. Clark Fitts, of Montreal for biscuits.

HONOURABLE MENTION.

Mr. Gamble, of Etobicoke, for flour.
Mr. Lawson, of Montreal, for flour.
Mr. McDougal, of Montreal, for flour.
Mr. Nasmith, of Toronto, for buiscuit.
Mr. Proctor, of Montreal, for flour and Indian corn.
Mr. Robb, of Montreal, for biscuit.

TWELFTH CLASS.

Hygiene, Pharmacy, Surgery, Medicine, comprising Hygiene and Public Health, Hygiene in Private Life, use of Water, Vapour and Gas, Anatomy of man, and comparative Anatomy, Veterinary Medicine and care of Horses.

SECOND CLASS MEDAL.

Mrs. McCulloch, of Montreal, for a collection of stuffed birds from Canada.

HONOURABLE MENTION.

Prof. Croft, of Toronto, for officinal preparations.
Mr. Lyman, of Montreal, for officinal preparations.

THIRTEENTH CLASS.

Naval and military arts, comprising the principal elements of the materials used in Ship-building, and of the art of navigation, swimming apparatus, life-boats and diving-bells, drawings and models of ships, boats, &c., used on rivers, canals and lakes, and commerce and deep sea fishing, drawings and models of vessels of war and military engineering, materials of war and military equipage, equipment of troops, arms and projectiles, pyrotechnics.

FIRST CLASS MEDAL.

Mr. Lee, of Quebec, for models of steam and sailing vessels.

SECOND CLASS MEDAL.

Mr. Cantin, of Montreal, for boat oars.

HONOURABLE MENTION.

Captain Thomas, of Toronto, for a model of a life-boat.

FOURTEENTH CLASS.

Civil Engineering comprising building materials, the divers branches of work connected with building, foundations, works in connection with marine navigation, roads and railways, bridges, distribution of water and gas, special buildings.

FIRST CLASS MEDALS.

Public Works Office, for models and materials.
Geological Commission, for building materials.
Mr. Ostell, of Montreal, for wooden doors and window sashes.

SECOND CLASS MEDAL.

Mr. Brown of St. Catherines, for building materials.

HONOURABLE MENTION.

Shipton Slate Company, for slates.
Hamilton International Company, for asphalt.
Mr. Gauvreau, of Quebec, for Quebec hydraulic cement.

FIFTEENTH CLASS.

Steel and its products, comprising the manufacture of steel for the market, manufacture of special kinds of steel, springs, cutlery, steel tools, various steel manufactures.

SECOND CLASS MEDALS.

Mr. Scott, of Montreal, for tools.
Mr. Higgins, of Montreal, for axes.
Mr. Parkyn, of Montreal, iron shovels.

HONOURABLE MENTION.

Mr. Date, of Galt, for tools.
Mr. Dawson, of Montreal, for planes.
Mr. Wallace, of Montreal, for planes.

SIXTEENTH CLASS.

General metal work, comprising elaboration of metals and alloys, wires, large tubes, copper ware, sheet iron, tin ware, metal wire work, ironmongery and nail-making, locksmith's work and hardware, zinc work, lead work, tin work, and various white alloys, precious metals.

HONOURABLE MENTION.

Mr. Peck, of Montreal, for nails.
Mr. Jones, of Gananoque, for iron instruments.
Mr. Parkyn, of Montreal, for iron instruments.
Mr. Rice, of Montreal, for tin.

SEVENTEENTH CLASS.

Goldsmith's and Silversmith's work, jewellery, bronzes, comprising processes used in goldsmith's work, cutting and engraving of stones used in jewellery, manufacturers of precious metals, plated goods, jewellery, imitation jewellery, jewellery made of various metals, statues, bronzes.

No prizes to Canada.

EIGHTEENTH CLASS.

Glass and pottery, comprising general processes used in making glass and pottery, window glass and mirror glass, bottle glass, crystal glass, crystal, &c., for optical instruments, ornaments, common pottery, and terra cotta, faience, stone ware, porcelain, artistical objects.

No prizes to Canada.

The NINETEENTH, TWENTIETH, TWENTY-FIRST, and TWENTY-SECOND CLASSES were devoted to cotton, woollen, silk, and flax manufactures, in which departments no prizes were awarded to Canada.

TWENTY-THIRD CLASS.

Hosiery, carpets, embroidery, lace of every kind, gold and silver fringes, comprising all articles of these

different classes manufactured of silk, floss silk, wool, horse hair, thread and cotton.

SECOND CLASS MEDAL.

Government of Canada for their collection.

HONOURABLE MENTION.

Mrs. Jones, of Montreal, for a screen worked in wool.

Miss Parthenais, of L'Industrie, for embroidery in wool and silk.

TWENTY-FOURTH CLASS.

Furniture and decoration, comprising decorative furniture made of stone, stony substances or in metal, cabinet work for daily use, fancy furniture and decorative articles characterized by the use of costly woods, ivory, shell, by sculpture and inlaid work, furniture of moulded substances, gilt, lacquered, &c., furniture made of reeds, cane, straw, &c., household utensils, upholsterers' work, stained paper, stuffs and leather prepared for hangings, blinds, book-binding, &c., decorative painting, fittings for theatres, public ceremonies, &c., church furniture, ornaments and decorations.

SECOND CLASS MEDALS.

Mr. Drum, of Quebec, for a chair of waved maple.

Mr. Hilton, of Montreal, for a collection of furniture.

HONOURABLE MENTION.

M. Bevis, of Hamilton, for a mosaic table.

Mrs. Widder, of Toronto, for a drawing room chair.

Mr. MacGarvey, of Montreal, for rocking chairs.

TWENTY-FIFTH CLASS.

Articles of clothing, objects of fashion and fancy, comprising materials used in making clothes, buttons, linen drapery, stays, braces and garters, coats and clothes, boots and shoes, gaiters and gloves, hats and caps, hair work, feather and bead head dresses, ornaments, artificial flowers, needle work, fans, screens, parasols, umbrellas, sticks, articles of hardware in wood, ivory and shell, &c. Dressing-cases, inkstands, fancy articles ornamented with ivory, &c , sheaths and manufactures in morocco leather and cardboard, basket work, &c., toys, dolls, wax figures, games of all kinds.

SECOND CLASS MEDAL.

Mr. Barbeau, of Quebec, for hunting and riding boots.

Mr. Henderson, of Quebec, for a beaver pelisse.

Mr. Mercier, of Quebec, for Indian work.

The Montreal India Rubber Company.

Mr. Smith, of Montreal, for a collection of boots and shoes.

TWENTY-SIXTH CLASS.

Drawing aud modelling applied to industry, letter press and copper-plate printing; photography, comprising writing, drawing, and painting; lithograph, autograph, and stone engraving, engraving on metal or wood, stereotyping, moulds and stamps, printing.

HONOURABLE MENTION.

Miss Cochran, of Quebec, for fruit in wax work.

Mr. Doane, of Montreal, for photographs.

Mr. Miller, of Montreal, specimens of book-binding.

Mr. Palmer, of Toronto, specimens of daguerreotypes.

The Sisters of Providence of Montreal, fruits in wax work.

Mr. Young, of Montreal, specimens of book-binding.

TWENTY-SEVENTH CLASS.

Manufacture of musical instruments, comprising wind instruments in wood, horn, ivory, bone, shell, leather and metal; wind instruments with key-boards, stringed instruments without key-boards, pulsatile instruments, automaton instruments, manufactured articles and accessories.

No prizes to Canada.

MISCELLANEOUS.

SECOND CLASS MEDAL.

Mr. Idler, of Montreal, for preserved meats.

Mr. Smith, of Montreal, for boots and shoes.

HONOURABLE MENTION.

Mr. Cross, of Montreal, for cheese.

The total number of prizes awarded at the Exhibitions of London, New York, and Paris, were as follows:—

At London, 67 medals and honorable mentions.
At New York, 63 " " "
At Paris, 93 " " "

In the report of J. C. Taché, Esq', M.D., one of the Canadian commissioners to Paris in 1855, and one of the commissioners for Canada at the approaching International Exhibition of 1862, the following opinions of competent authorities on the success of Canada at Paris are enumerated.

The chapter under the title Canada, in the history of the Universal Exhibition, by Mr. Charles Robin, begins with these words: "The efforts made by Canada, that old French colony, to make a suitable appearance at the Great Exhibition of 1855, efforts which have resulted, moreover, in the most complete success, coupled with the undoubted importance of that fine country, whose future cannot be otherwise than brilliant, render it a duty on our part to devote to it a distinct chapter."

"*Now we can form an estimate of the value of these few arpents of snow ceded to England with such culpable carelessness by the Government of Louis XV.*," says Count Jaubert at the word CANADA, in his work entitled *La Botanique à l'Exposition Universelle de* 1855.

Baron Wedekin, Chief Ranger of the Duchy of Hesse, and compiler of the records of the German forests, writing to Dr. Taché, states: "In conclusion I congratulate you upon your Canada. Although the feeling in favor of emigration has very much diminished in Germany, I would recommend Canada to the emigrant in preference to any other country."

The standing acquired by Canada, in competing with other nations and colonies, may be inferred from the fact that the prizes received at the Great

Exhibition of London, in 1851, were 67 medals and honorable mentions; at New York, in 1853, 63 similar distinctions; and at Paris this number was increased to 93; Canada being the only instance of a Colony having obtained a grand medal of honour, a distinction won but not exceeded by the nationalities of Sweden, Denmark, Lombardy, Piedmont, and Bavaria.*

The Board of Arts and Manufactures

FOR UPPER CANADA.

CIRCULAR.

BOARD ROOMS,
TORONTO, November 30th, 1861.

The Executive Committee of the Board of Arts and Manufactures for Upper Canada, beg to direct attention to the Circular on the first page of this number of the Journal, which has just been issued by the Commissioners appointed by the Provincial Government to secure a proper representation of Canada at the International Exhibition, to be held in London in 1862.

For the purpose of promoting this national object, the Commissioners have applied to this Board for its advice and co-operation, which has been cheerfully accorded; the Committee therefore respectfully call upon the manufacturers and producers of Canada, promptly to respond to the Circular of the Commissioners, and put forth their utmost exertions towards securing such a representation of Canadian Art and Industry, as shall be creditable to us as a people, and enable the Province to maintain, at the third Great Exhibition of all Nations, the position so honorably attained at London in 1851, and at Paris in 1855.

The Committee regret that the time for preparation is so limited, owing to the delay on the part of the Government in appointing the Commissioners, through whom alone exhibitors are in a position to communicate with Her Majesty's Commissioners in London—so limited indeed, that in many departments in which it would have been highly desirable to have contributed articles of Canadian origin, any efforts would now be of no avail.

In the special report of this committee on this subject, adopted by the Board and published in the April No. of its Journal, the several departments in which the Province should be represented were indicated in the following classification, namely:—

I.—Agricultural Productions.

(This department will be attended to by the Board of Agriculture.)

II.—Productions of the Forest.

Timber.
Gums and Resins.
Oils.
Dye Stuffs.
Tanning Materials.
Miscellaneous.

III.—Productions of the Mine.

1. Metals and their ores.
2. Minerals requiring more complicated chemical treatment to fit them for use.
3. Mineral paints.
4. Materials applicable to the fine arts.
5. Materials applicable to jewellery.
6. Materials for glass-making.
7. Refractory materials.
8. Grinding and polishing materials.
9. Materials applicable to the purposes of common and decorative construction.
10. Miscellaneous materials.

IV.—Animal Productions.

1. Glue.
2. Isinglass, from the Sturgeon.
3. Neat's foot Oil.
4. Bees' Wax.
5. Lard Oil.
6. Moose, Cariboo, Bear, &c., Skin.
7. Furs.
8. Porpoise Leather.
9. Whale Leather.
10. Sealskin Leather.

V.—Productions of the Fisheries.

1. Seal Oil.
2. Cod liver oil.
3. Porpoise oil (*Delphinus Minor*).

[This oil is particularly valuable on account of its retaining its fluidity at extremely low temperatures.]

4. Porpoise leather.
5. Whale oil.
6. Capelin oil.
7. Shark Oil.
8. Fish manure.

All of the oils should be sent in the raw state and also clarified.

VI.—Manufactures, &c.

I.—MACHINERY.

1. Machines for direct use, including Carriages, Railway and Marine Mechanism.
2. Manufacturing Machines and Tools.

* See article on "Canada at the International Exhibition of 1862," age 57 of this journal.

3. Civil Engineering, Architectural and Building Contrivances.
4. Philosophical, Musical, Horological, and Surgical Instruments.

II.—MANUFACTURES.

1. Woollen and Worsted.
2. Flax, Hemp and Cotton.
3. Leather, Saddlery, Boots and Shoes.
4. Skins and Hair.
5. Paper, Printing and Bookbinding.
6. Woven, Felted and Laid Fabrics.
7. Dyed and Printed Goods.
8. Carpets, Oil Cloths, &c.
9. Articles of Clothing.
10. Cutlery, Edge and Hand Tools.
11. General Hardware.
12. Gold and Silversmith's Work.
13. Furniture, Upholstery, &c.
14. Manufactures in Mineral substances, for Building or Decoration.
15. Manufactures from Animal and Vegetable substances not woven or felted.
16. Miscellaneous Manufactures and Small Wares.

In the Circular above referred to, parties intending to exhibit are requested to notify the Commissioners of their intention, through B. Chamberlin, Esq., Commissioner, Secretary, in Montreal, on or before the fourth of December next.

Intending exhibitors in Upper Canada, who may not have been able to give the requisite notice within the time specified, are nevertheless requested to communicate their wishes to the Secretary of this Board, at the earliest possible moment, and their application will be submitted to the Commissioners without delay.

W. EDWARDS, *Secretary.*

CIRCULAR NOTICE TO BOARDS OF DIRECTORS OF MECHANICS' INSTITUTES.

The Board of Arts and Manufactures has been requested by the Provincial Commissioners, appointed in connection with the International Exhibition of 1862, to render such advice and assistance to the Commissioners as may be within their power, in securing a proper representation of the Arts and Industry of Canada; the Board therefore requests that you will communicate, as a special Committee, with the Manufacturers and Artizans of your locality, for the purpose of obtaining suitable contributions, to be submitted to the Commissioners, for their approval.

Mr. George E. Pell has been appointed Agent for this Board, for the Western Section of U. C., and Mr. E. A. McNaughton for the Eastern Section, for the purpose of Canvassing for Subscribers for the *Journal;* for information relating to Manufactures; and for specimens of Native Manufactures for the Museum of the Board.

The Agent for your Section will also avail himself of any opportunity you may afford him of meeting your Committee, in relation to the International Exhibition, and other matters.

The Board respectfully solicits for these gentlemen, your active coöperation and assistance.

W. EDWARDS,
Secretary.

November 30th, 1861.

CANADIAN PATENTS,

BUREAU OF AGRICULTURE AND STATISTICS, Quebec, 29th November, 1861:—

Chester Chattuck, of the City of Toronto, County of York, Tanner, for "A new Composition of Matter for tanning leather."—(Dated 7th January, 1861.)

Cyrus Kinney, of the Township of Dereham, County of Oxford, Yeoman, Assignee of Israel Kinney, of the Town of Simcoe, County of Norfolk, Waggon Maker, for "A new mode of applying power to any machinery by combining rotary motion with the inclined plane." —(Dated 10th January, 1861.)

Ferdinand D. Lloyd, of the City of Toronto, County of York, Tinsmith, for "Lloyd's Patent Broadcast Seed Sower."—(Dated 12th January, 1861.)

Jehiel Churchill, of the Township of Pickering, County of Ontario, Yeoman, for "A Stump Extractor."—(Dated 16th January, 1861.)

Samuel D. Shorts, of the Township of Richmond, County of Lennox, Yeoman, for "A machine for the manufacture of Cheese and Butter, termed the Dairy Maid."—(Dated 16th January, 1861.)

Frederick Rodgers, of the City of Hamilton, County of Wentworth, Manufacturer of Sewing Machines, for "An improved Cam for working the under needle or catch-pin of Sewing Machines."—(Dated 16th January, 1861.)

James Armstrong, of the Township of Bathurst, County of Lanark, Blacksmith, for "A new and improved Churn, termed The Jenny Lind Churn."—(Dated 16th January, 1861.)

David Fell, of the Town of Cornwall, County of Stormont, Saloon Keeper, for "A new and improved Rotary Lever Churn."—(Dated 16th January, 1861.)

Henry Palmer, of the City of London, County of Middlesex, Gentleman, for "A new Electro Voltaic Pocket Battery."—(Dated 16th January, 1861.)

Francis Ervin and William Beemer, both of the Township of Brantford, County of Brant, Carpenters, for "A Horizontal Lever Washing Machine."—(Dated 24th January, 1861.)

Edward G Maxwell, of the City of Montreal, Carpenter, for "A Spring Latch, to be called Maxwell's Spring Latch."—(Dated 25th January, 1861.)

PROCEEDINGS OF INSTITUTES.

Toronto Mechanics' Institute.

The Quarterly Meeting of the Members of this Institution was held on Monday, the 18th of November; the President, Rice Lewis, Esq., in the chair.

The board of Directors, in their report submitted to the Meeting, congratulated the Members on meeting them in their New Hall, undoubtedly one of the most complete of its kind on the continent.

The report alluded to the great expense incurred in decorating the Music Hall; and in finishing and furnishing the numerous rooms in the building, (31 in number besides passages) which, with the steam heating apparatus now nearly completed, will exceed the amount at the credit of the Board by about one thousand dollars. To raise this large sum of money it is proposed to hold a Bazaar, or Exhibition Sale, in connection with the Inauguration of the Building, on the 23rd and 24th of December (instant); and the Directors rely on the Active Cooperation of the Members in Making, and obtaining from their friends, contributions of Ladies' Work, Mechanical Specimens, and Articles of Utility and Ornament. Several valuable specimens have already been presented, and a Committee of Ladies have announced their determination to do their utmost in furtherance of this object.

The hope previously entertained respecting the increased prosperity of the Institute, when it should remove to its new premises, has been fully realised in the increase to the number of its members; and should the increase continue for the next six months, in the same ratio as in the past the Membership will have doubled itself within the year. The Library has also been increased during the same period by nearly 1,000 volumes; and the Reading Room has received many important additions.

The report also stated that arrangements have been made for establishing classes in Free hand Drawing and Painting, Architectural and Mechanical Drawing, Elocution, and the Theory and Practice of Music; and invites the support of the members to this important department of the Institute.

The Board has made no arrangements for a regular course of Lectures during the coming season, but will embrace any opportunities that may occur for securing the services of Lecturers on appropriate subjects, without interfering with ground already occupied.

The Report was unamimously adopted.

The Members generally expressed themselves as well satisfied with the Management of the Board of Directors, in the several departments of the Institute, and gratified at the progress the Institute is making, when the Meeting abjourned.

THE SECOND VOLUME OF THE

Journal of the Board of Arts & Manufactures

FOR UPPER CANADA.

ENLARGEMENT OF THE JOURNAL.

This number will close the First Volume of the Journal of the Board of Arts and Manufactures for Upper Canada. When the Board for Upper Canada issued their prospectus in December, 1860, they did not look upon the proposed issue of a monthly periodical devoted to the encouragement of Arts and Manufactures in the light of an experiment, which might fall to the ground through neglect or indifference, they considered it to be their duty to embrace and secure by every means at their disposal, opportunities of affording encouragement and assistance to home industry. In no way could this object be better attained than by a medium through which its operations and those of kindred institutions could be made known in the Province, and many of the intellectual wants of a numerous class engaged in manufacturing industry throughout the country, supplied if made known.

In all respects, with the exception of correspondence, has the Journal met with the anticipations of its promoters. As it is impossible with the means at our disposal to obtain information respecting local progress or local wants, we again call attention to that paragraph in the prospectus which refers to the coöperation of others. "All who are engaged in industrial pursuits, capable of improvement or extension, can recognize the advantages which a journal of the character proposed is capable of conferring; and it is earnestly hoped that many will be willing to contribute information as to what is *now doing* in Canada, and suggestions as to *what may be done* with profit to individual enterprize and advantage to the Province." Such, however, has been the share of encouragement awarded to this Journal, that the Board has determined to enlarge it by four additional pages in each number, or 48 pages in the volume. The monthly issue will also be printed on a larger sheet, and supplied with a cover, stitched and cut. These improvements will, we trust, be met in a liberal and encouraging manner by Mechanics' Institutes, Reading Associations, and private individuals. The Journal is supplied at the following rates:—At $1 per annum for single copies, or to Clubs of ten or more at 75 cents per copy; to members of Mechanics' Institutes, and of Literary, Scientific and Agricultural Societies, through their Secretary or other Officer, 50 cents per annum per copy.

Vol. I., neatly half bound in coloured sheep, will be supplied for $1; and to Members of Mechanics' Institutes, &c., &c., at 75 cents per copy.

NEW WINDMILL POWER FOR GRINDING, &c.

Patented by R. H. Oates, Toronto, August 9th, 1861.

The principle of this invention is, that the Mill House revolves on a Circular Foundation, so as to keep the sails towards the wind; the sails being self-adjusting will cause the Machinery to run as steady n Squalls or a Storm, as in moderate wind. It is estimated that a Grist Mill on this plan can be built and completed for about $2,000, with two run of Burr Stones, two Bolts, &c.

Description of Building.—" Build a circular stone foundation, say 32 feet diametar, two feet thick, two feet above, and as much below the ground as will keep it from being affected by frost. On the top of this, place a circular plate of timber 12 inches square, frame into this two cross braces same size, crossing each other exactly in the centre of the circle. Bolt this wooden circular plate secure by wrought iron bolts coming up through the stone foundation. On the top of this timber circle, bolt or spike on a circular cast iron plate, half an inch thick and four inches broad; on the centre of the cross formed by the two braces, place a cast iron centre post 10 or 12 inches in diameter three feet high with a flange at the bottom two inches thick and 18 inches diameter with 8 bolt holes, $1\frac{1}{4}$ inch diameter. This flange is sunk flush into the timber and bolted fast by 8 wrought iron bolts, $1\frac{1}{4}$ inch diameter. Twelve inches above the flange, a collar is cast on, and 15 inches above the collar is a key hole with key and washer. The Mill House is 18 feet square at the base and 9 feet square at the top; the posts are from 25 to 30 feet high.

One corner of the Mill House is the weather corner out through this corner and as near the top as possible comes the wind shaft to carry the sails. This weather corner rests on the collar of the iron centre post. The main body of the Mill House from side corner to side corner with 9 cast iron wheels 12 inches diameter and 4 inches thick underneath, rest on the circular iron plate track. The lee corner over-hanging the circular foundation about 8 feet. The iron centre post will come up through an iron ring in the lower floor just inside of the weather corner with washer and key above said floor."

Advantages of this Plan.—The Mill House swings on the circular base round the iron centre post as the wind changes, like a ship at anchor. This is an advantage over the old Post Mill which has to be shifted by hand. The Mill with a revolving top is self-acting in part by the help of a small fantail wheel to bring the sails to the wind when wrong, but at times, in sudden squalls, this fantail wheel does not operate quickly enough and the sails are blown off; in consequence the Miller has to be very watchful of the weather, or his Mill will meet with serious accidents. While a Miller in a Mill on my plan, need not trouble himself about the weather, let it come as it may, the Mill takes care of itself. Its advantage over Water Mills is, that you can build this Mill where you please, and its advantages over Steam being that the driving power costs nothing.

The patentee offers a free right and all the necessary information, to whoever builds the first Mill on this plan.

BRITISH PUBLICATIONS FOR OCTOBER.

	Stg. prices.			
Abercromby (Lieut.-Gen. Sir Ralph), A Memoir by his Son, James Lord Dunfermline, 8vo	£0	10	6	*Edmonston.*
Amateur Illuminator's Magazine, and Journal of Miniature Painting, No. 1, sm folio	0	2	6	*Day & Son.*
Anderson (T. M'Call) On the Parasitic Affections of the Skin, 8vo	0	5	0	*Churchill.*
Apel (Madame) Essentials of French Grammar, 18mo	0	0	9	*Cornish.*
Barlow (Geo. Hilaro) Manual of the Practice of Medicine, 2nd edit., fcap. 8vo	0	12	6	*Churchill.*
Bayley (W. H.) Handbook of Slide Rule, its Applicability to Arithmetic, &c., 12mo.	0	6	0	*Bell & Daldy.*
Beadle's American Biographies. Life of Pontiac, the Conspirator, by E. S. Ellis, fcap. 8vo	0	0	6	*Beadle.*
Beale (Lionel S.) On the Structure of the Simple Tissues of the Human Body, 8vo.	0	7	6	*Churchill.*
Beamont (Rev. W. J.) Cairo to Sinai and Sinai to Cairo, in Nov. and Dec., 1860, fcap. 8vo	0	5	0	*Bell & Daldy.*
Beeton (Mrs. Isabella) Book of Garden Management, Part 1, 12mo	0	0	3	*Beeton.*
——— Household Management, with illustrations, post 8vo.	0	7	6	*Beeton.*
Bohn's Classical Library. Demosthenes' Orations against Timocrates, &c., trans. post 8vo	0	5	0	*Bohn.*
——— English Gentleman's Library. Walpole's Letters, Vol. 7, 8vo	0	9	0	*Bohn.*
Book of Familiar Quotations (The) from the Best Authors, 3rd edit. fcap. 8vo	0	5	0	*Whittaker.*

	£	s.	d.	
Bourne (John) The Cotton Crisis, and How to Meet it: a Letter, 8vo	0	1	0	*Longman.*
Briggs (H. George) The Nizam: his History, and Relations with Brit. Government, 2 vols. 8vo	2	2	0	*Quaritch.*
Bristow (Hen. Wm.) Glossary of Mineralogy, post 8vo	0	12	0	*Longman.*
Brookes (R.) General Gazetteer, in miniature, by A. G. Findlay, roy. 18mo. advanced to	0	5	0	*Tegg.*
Bruce's Travels and Adventures in Abyssinia, illust., sup.-roy. 16mo. reduced to	0	3	6	*Black.*
Burn (Robt. Scott) Illust. of Mechanical Movements and Agricultural Machines, 4to	0	3	0	*Chambers.*
Chain (A) of History, Part 1.—From Nimrod to Charlemagne, 18mo	0	1	0	*Simpkin.*
Chalmers (James) The Channel Railway, connecting England and France, roy. 8vo.	0	3	6	*Spon.*
Chide (Rev. G. F.) Singular Proprieties of the Ellipsoid, &c., 8vo	0	10	6	*Macmillan.*
Circle of the Sciences (The), Vol. 8 —Mathematical Sciences, new edit., cr. 8vo	0	5	0	*Griffin.*
———— new edit.. Vol. 9.—Mechanical Philosophy, cr. 8vo	0	5	0	*Griffin.*
Collier (Wm. Francis) History of English Literature, sm. cr. 8vo	0	3	6	*Nelson.*
Cooper's Dictionary of practical Surgery, new edit., by S. A. Lane, Vol. 1, 8vo	1	5	0	*Longman.*
Craik (Geo. L.) History of English Literature and the English Language, 2 v. 8vo.	1	4	0	*Griffin.*
Delamotte (F. G.) Mediæval Alphabets and Initials for Illuminators, fcap. 4to	0	6	0	*Spon.*
Dickes (W.) Studies from the Great Masters, Part 8, imp. 4to	0	2	0	*Hamilton.*
Dobell (Horace) Lectures on the Germs and Vestiges of Disease, 8vo	0	6	6	*Churchill.*
Drew (Samuel), the Self-taught Cornishman, a Life Lesson, 12mo	0	3	6	*Ward & Co.*
Dumas' Historical Library.—The Page of the Duke of Savoy, fcap. 8vo	0	2	0	*C. H. Clarke.*
Ellis (Edward S) Life of Pontiac the C nspirator, fcap. 8vo	0	0	6	*Beadle.*
Elwes (Alfred) Richmonds' Tour in Europe, new edit., cr. 8vo	0	2	0	*Routledge.*
Exeter, History of the City of, by Rev. George Oliver, 8vo	0	12	6	*Longman.*
Gamgee (Jno.) and Law (Jas.) Anatomy of the Domestic Animals, illust., roy. 8vo.	0	12	0	*Simpkin.*
Ganot (A.) Elementary Physics, edit. by E. Atkinson, Part 1, post 8vo	0	1	0	*Baillière.*
Glenny (Geo.) Properties of Fruits and Vegetables, a Guide to Judges, &c., fp. 8vo.	0	1	0	*Houlston.*
Gosse (P. H.) Natural History: Birds, Mammals, Reptiles, fcap. 8vo, red. to each.	0	2	6	*Soc. Pr. Ch. Kn.*
Graham (Frederica) Visits to the Zoological Gardens, new edit. cr. 8vo	0	2	0	*Routledge.*
Grant (James) Jack Manly: his Adventures by Sea and Land, illust., fcap. 8vo	0	5	0	*Routledge.*
Grindon (Leo H.) Manual of Plants, British and Foreign	0	3	6	*Pamplin.*
Hall (Newman) Land of the Forum and the Vatican, new edit., sm. cr. 8vo	0	6	0	*Nisbet.*
Handy Book (A) to the Sky, Air, Earth, and Waters, post 8vo	0	1	6	*Ward & Lock.*
———— Animal Kingdom, post 8vo	0	1	6	*Ward & Lock.*
———— Vegetable Kingdom, post 8vo	0	1	6	*Ward & Lock.*
Holden (Luther) Manual of the Dissection of the Human Body, 2nd edit. 8vo	0	16	0	*Churchill.*
Holland (J. S.) Office Companion for Engineers and Officers of Steam Vessels, fp. 8vo	0	5	6	*Atchley.*
Hulke (J. W.) On Use of the Ophthalmoscope, Jacksonian Prize Essay, 1959, sup.-r. 8vo	0	8	0	*Churchill.*
Hull (Edward) Map of the British Coal Fields, cr. 8vo	0	4	6	*Stanford.*
Ibris (The): a Magazine of General Ornithology, edited by P. L. Sclater, 8vo	1	6	0	*Trubner.*
Londonderry: The Siege and History of, edit by John Hempton, 12mo	0	4	6	*Simpkin.*
Lupton (J. J.) Anatomy of the External Form of the Horse, Part 2, folio	0	15	0	*Baillière.*
Maddock (A. B.) On Medicated Inhalations in Pulmonary Consumption, 10th ed., 8vo	0	1	6	*Simpkin.*
———— Pulmonary Consumption Treated by Medi. Inhalat. 10th ed., 8vo.	0	3	6	*Simpkin.*
Odling (William) Manual of Chemistry, Descriptive and Theoretical, Part 1, 8vo	0	9	0	*Longman.*
Olmstead (Fred. Law) Journeys and Explorations in the Cotton Kingdom, 2 vols. cr. 8vo	1	1	0	*Law.*
Park (Mungo) Travels in the Interior of Africa, illust., sup.-roy. 16mo, red. to	0	3	6	*Black.*
Perry (R.) Contributions to an Amateur Magazine, 2nd edit., cr. 8vo	0	8	6	*Rivingtons.*
Philips' Atlas of Physical Geography, edit. by William Hughes, 20 Maps, imp. 8vo.	0	10	6	*Philip & Son.*
Phillips (J. A.) and Darlington (J) Records of Mining and Metallurgy, cr. 8vo, reduced to (sd. 3s.)	0	4	0	*Spon.*
Pratt (Anne) Flowering Plants and Ferns of Great Britian, 5 vols. 8vo, red. to each.	0	10	6	*Soc. Pr. Ch. Kn.*
Sala (G. Aug.) Dutch Pictures, with some Sketches in the Flemish Manner, cr. 8vo.	0	5	0	*Tinsley.*
Scott (George Gilbert) Gleanings from Westminster Abbey, illust. 8vo	0	7	6	*J. H. & J. Parker.*
Sowerby's Grasses of Great Britian, with Observations, &c., by C. Johnson, roy. 8vo.	1	14	0	*Sowerby.*
Spanish Peninsula (The): a Sketch of its Past History, &c , fcap. 8vo	0	3	6	*Rel. Tr. Soc.*
Swinhoe (Robert) Narrative of the North China Campaign of 1860, 8vo	0	12	0	*Smith & Elder.*
Wall (Alfred H.) Manual of Artistic Colouring as applied to Photographs, cr. 8vo	0	6	6	*T. Piper.*
Wood (Rev. J. G.) Illustrated Natural History; Birds, sup.-roy. 8vo	0	18	0	*Routledge.*
Wylle (J. A.) Wanderings in the Valleys of the Waldenses, fcap. 8vo, red. to	0	2	6	*Griffin.*

AMERICAN PUBLICATIONS FOR NOVEMBER.

Anderson—Okavango River; A Narrative of Travel, &c., 8vo	$2 00	*Harper & Bros.*
Emerson (Geo. B.) Manual of Agriculture for the School, the Farm, &c., 12mo	0 75	*Swan, Brewer, & Tileston.*
Hopkins (Samuel) The Puritans, during the reign of Edward VI., and Elizabeth, vol. 3.	2 50	*Gould & Lincoln.*
Marsh (Hon. G P.) Lectures on the English Language, 8vo	3 00	*Chs. Scribner.*
Olmsted (F. L.) Observations on Cotton and Slavery in the U. States, 2 vols., 12mo	2 00	*Mason & Bros.*
Pfeiffer (Ida) Last Travels of, with Autobiographical Memoir, 12mo	1 25	*Harper & Bros.*
Staunton (Rev. W.) An Ecclesiastical Dictionary	2 50	*Harper & Bros.*
Taylor (Samuel H.) Method of Classical Study, 12mo	0 75	*Brown & Taggard*

Selected Articles.

ON WASTE.

(*Continued from page* 302.)

A patent has been recently obtained for cutting up the clippings of leather, and introducing them into the soles of boots and shoes, rendering them easier to the wearer and quite as durable; thus saving new material. Leather cuttings are also employed in the manufacture of Prussian blue. I have recently had some paper presented me by the Messrs. Schlagentweits, the celebrated German travellers, made in Berlin, from the cuttings of leather. The paper is remarkably tough, and apparently adapted for serviceable purposes; but it has not yet been used in sufficient quantity to render it a profitable manufacture.

I have hitherto been speaking of the physical properties of waste substances; but waste matters are composed of chemical elements, which can be changed into other compounds by which we can get new substances; and some of our most extensive manufactures depend on this fact. All the substances of which I have spoken—the clippings of leather and the fibres of wool and silk,—whatever animal substances we may have, are composed of the four elements,—carbon, hydrogen, oxygen, and nitrogen. We find all these elements in carbonate of ammonia. Now the difference of these elements, as they exist in the carbonate of ammonia and as they exist in bones, or in hoofs, or in horns, or in wool, or in skin, is this—that the elements of the animal body are much more easily changed, and more readily made to assume combinations which are useful to man, than if he had to deal with mineral compounds. Hence it is that he prefers to work chemically at the gelatine or wool, or some other constituent, than to take carbonate of ammonia, which is cheap enough but not the easiest to work with.

With this view I will now speak of skin waste. The tanner has waste. While he is preparing his skins, he cuts off the fat and the portions which cover the legs and the ears. He sells all these. The oil and the fat are sold to those who boil down oils and fats of all kinds. You will recollect that the oils and fats can be made into soap; and it is no matter whether the oil or fat be obtained from skins or from other sources. Then again this oil and this fat, obtained from the tanners' waste is made to yield its stearic acid. Its glycerine may be obtained for all the purposes to which it can be applied, and its stearic acid may be manufactured into candles. The bits of skin are carefully collected and boiled down with various other odds and ends of animal substances. The various sources from which these pieces and scraps of skin are obtained are very numerous. They are bought by the manufacturer, and after some process of selection, they are placed in large vessels and boiled in water, and thus they are made to yield gelatine. The oil contained in those substances floats to the top. If the manufacturer wants a coarse and common tallow, it is employed as it is taken off; but if you are to have a better kind, it is afterwards prepared with great care. The water being evaporated, the gelatine is then procured. If the gelatine is to be used as size in the arts, it is less carefully prepared than if it is to be sent to your table as isinglass; and, let me tell you, whether you get the isinglass from the sounds of the sturgeon or from these things, it is all the same to you; for they are boiled down and purified, and can do no harm. Perhaps, with regard to these materials which have the same composition, from whatever source they are derived, it is best to ask as few questions as possible. The manufacturer of gelatine asks no questions, and perhaps it is prudent that you should ask none. This gelatine is certainly a very interesting substance, on account of the great variety of forms it assumes. According as it is used for one purpose or another, it is prepared carefully or not. When it is used in the arts for adhesive purposes, as in the form of glue, it need not be so destitute of colour or so carefully prepared. On the continent it is now manufactured into all kinds of forms. Large sheets are made for the purpose of colouring glass, for cutting up and forming into artificial flowers. It is used for the internal decoration of rooms, and for the wrappings of sweat-meats. Those who are in the habit of cracking *bon-bons* at the supper-table will recollect that they are wrapped up in this coloured gelatine. This manufacture is entirely dependant upon the use of what was a few years ago regarded as waste material.

I now come to the waste in bones. I mentioned that buttons were made of bones, and handles of knives, and a variety of useful articles, are made of bones. The buttons are punched out of the bones, and the pieces that are left are not lost. The dust made in sawing bones is collected; and butcher's bones and household bones are all used. They are first boiled down, and the fat is taken off, as in the case of the skin, and then their gelatine is dissolved, and the gelatine is used for glue, or size, or isinglass. In the bone that is left, there is still useful material, which may be employed for various purposes. The refuse of the bone-boiler is now commonly introduced into a closed furnace, by which a peculiar kind of animal charcoal is produced. So you see that after they have made buttons they are used for making size, gelatine, jelly, soap, and candles, and then they are still available for making animal charcoal. This charcoal, for many things, is better that any other; and this raises the question why this is the best? There is another form of animal charcoal obtained from burning blood, and which may be considered the best animal charcoal, because it contains the largest quantity of carbon; but it is found that this bone charcoal is better for filtering purposes than the ordinary animal charcoal, and at this moment it is fetching a higher price in the market. It is used especially for filtering water and refining sugar. You know that sugar is brought into this country in a brown state. Here it is melted and purified by passing through animal charcoal. One filtration is not sufficient, but a second is; and the charcoal which is found to be most efficient is this charcoal which is made from the refuse of bones after all the gelatine and fat have been extracted. It is probably, then, not so much the carbon which strains and keeps out this organic matter, as the phosphate of lime. Now, I do not mean to say that any one would make a fortune by it, but it is worth consideration whether common vegetable charcoal mixed with phosphate of lime may not answer as well. Here, perhaps, we may inquire, how it is that these charcoals act as purifying agents. I may say that this purifying action is not confined to water and sugar, but that chemists use animal charcoal as a means of purification for a variety of processes, It would seem, with regard to the water, that the animal char-

coal has a power of absorbing and holding, and, as it were, introducing oxygen to the impure substances contained in the water, so that they become oxidized and converted into something else; for we find that the animal charcoal retains its power of purification for several years. If, instead of oxidizing these substances and passing them through, it acted as a strainer or sieve, straining out the impure materials, then you would have the charcoal blocked up; but it is not so. These impure substances in water are all composed of carbon, hydrogen, and nitrogen. The oxygen oxidizes the carbon, and forms carbonic acid gas, which makes the water sparkling and refreshing. It oxidizes hydrogen, and converts it into water; it oxidizes nitrogen, and converts it into nitric acid. One of the impure-smelling substances in water is sulphur, and the oxygen unites with it; and thus we get sulphuric acid, or sulphates. Thus the impurities of the water are converted into substances which may be consumed without any injury whatever.

This, I think you will say, is a most remarkable instance of the application of waste to important purposes. This has really arisen out of the necessities of the bone-boilers, who, when they had obtained the fat and gelatine out of the bones, left them to accumulate and engender and send forth a smell of sulphur and ammonia, and other compounds, which made people object to the annoyance of bone-boiling houses near to them; and now, instead of allowing these bones to lie and produce these ammoniacal compounds, they are once thrust into a furnace, and converted into charcoal. Now, these things encourage us to go on. Let us not be beaten by bad smells. All these substances which throw out disagreeable odours—all these may be conquered and made to serve our highest and best purposes in life. The very sewers' smells, which are so injurious in the summer season of the year in this metropolis, even these may be made to form compounds with other substances, which, being conveyed on to the land, actually fertilize it; and the compounds of carbon, oxygen, hydrogen, and nitrogen of the sewers become the compounds which feed us in "our daily bread."

Then, suppose you had used your animal charcoal, and that it had become blocked up, what are you now to do with it? You cannot reburn it; but although it will not bear that process, it still contains phosphate of lime; it still contains that precious constituent which forms part of our bones, and the bones of the lower creatures. We must have that in our system, and where are we to get it from? The bread which we eat from day to day must have it. And where is the bread to get it from? Why, from the land on which it grows. If the land will not grow wheat, and the meadows grass, they must be made to do so. The soil may become exhausted, and has again and again been exhausted. We have instances of farms which have ceased to grow wheat because they have no more phosphate of lime. There are meadows which fail to grow grass because of the want of this phosphate. Then how can the farmer remedy this? In no way but by applying the phosphate to the soil; and this he may do by applying to his land the refuse of our great cities. But we may throw away our phosphate, we may pour it into our sewers and rivers, and thus destroy it, whilst our crops are exhausting our fields;—and this is the history of the great empires of antiquity. Why have they ceased to exist? History will give you a variety of reasons why they have sunk. Some will tell you that it was because of their immorality, and others because of their civilization. But you will find around the great cities of antiquity, of Africa, of Asia, and of Europe, that the soils have become exhausted of their phosphate of lime, and consequently their crops have failed. Man could not then bring his food from great distances, and he has been compelled to seek his food on exhausted soils. On this account the great cities of antiquity have been depopulated, and new colonies have sprung up in every part of the world. But modern chemistry has shown man how he can avoid this necessity. It has pointed out that we have in these decaying bones the material of future life: it has shown us that in the earth are the bones of extinct animals containing this precious phosphate of lime. Thus we now bring up these creatures of a pristine world, and throw their ashes on our land to fertilize our fields. In the form of coprolites and phosphatite, we now get this phosphate of lime from the green sand of Cambridge, the red crag of Suffolk, the lias of Gloucestershire, the weald of Sussex and the Isle of Wight. This phosphate, in a mineral form, has also been found in Estremadura, in Spain, that country of never-ending wealth. There it exists in thousands, tens of thousands, probably millions of tons; although Spain has not yet arrived at a knowledge of the importance of this substance, and sends little or none into the markets of Europe. We get it, however, from Sweden and Norway, and other parts of the world. And here we have an instance of the use of that which previously had no value, being made subservient to the highest purposes in the life of man.

The dust of bones and ivory is sold in the shops, and used for various purposes. Ivory filings are collected most carefully by the ivory-turner, and sold as ivory-dust. Jellies are made from ivory-dust, and they are supposed to be more nutritious than jellies made from other things. I have, however, told you, in previous lectures, that gelatine is not nutritious. However, we have in this ivory-dust phosphate of lime, and it may be that a portion of the phosphate is thus introduced into the system. Then, bone-shavings are used as a substitute for ivory-dust, and are employed for the purpose of making a jelly which is frequently administered to the sick. Ivory-dust and bone-shavings are also employed for making a size.

Passing the refuse of leather, skin, bone, and ivory manufactures, I come to a curious instance of the application of refuse to purposes in the arts. If you recollect what I said more particularly with regard to the preparation of cloth, you will remember that I stated that soap was frequently employed for the purpose of washing away the oil and other impurities in the wool. Now, this soap is used in such large quantities, that soap-suds have become a source of annoyance in the rivers in cloth-manufacturing towns; and it has occurred to chemists, that if the materials of the soap could be collected, they are of considerable value; and in some places there are arrangements made for arresting the suds, which contain both potash and oil in large quantities. When collected, sulphuric acid is added to the suds, and the soap is thus decomposed; the potash and the soda go to the sulphuric acid, whilst the fatty matter floats on the top; and in this way large quantities of useful matter are rescued from destruction in our manufactories. The fatty matter which rises to the

top of these soap-suds is skimmed off and made into soap again, or into candles, or converted into other products in which fat is used. I do not know whether in our domestic arrangements, it would be economical to keep a bottle of oil of vitriol, to enable us to skim off the fat from our soap-suds, but, at any rate, it is an interesting application of refuse, and ought not to be lost sight of.

Now, let me call your attention to another process. The fragments of woollen clothing, bone drillings, whalebone shavings, hoofs and horns, button-makers' refuse, horn-shavings, dried blood, woollen waste, all sorts of animal products, the sweepings of manufactories, the lost atoms, which could not be used or employed for anything else in the respective manufactories, are used for making crystaline salts, known by the name of *prussiates*. There are two of these prussiates generally known; one is a beautiful yellow salt,—the other is an equally beautiful red salt.

And what are these prussiates? It is just worth while studying them for a moment, to see what curious compounds result from animal chemistry. The word prussiate comes from prussic acid (which comes from Prussian blue,) which is also called hydrocyanic acid, and which is composed of hydrogen and cyanogen, and the latter is a compound of carbon and nitrogen. Old scraps of iron are collected together, and with potash and animal matter form these prussiates.

In order, then, to obtain these salts, we take three sets of substances:—1. Refuse of animal substances—blood, bones, hoofs, horns, &c., which yield nitrogen and carbon. 2. Old scraps of iron,—refuse iron, shoes from dead horses, rusty nails and worn-out iron hoops. 3. Potashes, Montreal ashes, the refuse, if you like, of hewn trees; and these supply the potassium. Now, when these things are exposed to heat together, they arrange themselves in this way:—the iron unites with the carbon and nitrogen in the form of cyanogen, forming ferro-cyanogen, and this compound unites with the potassium, forming the ferro-cyanide of potassium; and this is what these salts are—ferro-cyanides.

I will not go further into the history of these prussiates, but just say a few words about their use. I do not know that there is any use for this prussiate of potash alone; but let us see how it acts in combination with iron. There are two proportions of cyanogen, and two proportions of potassium, and one of iron. Now, if we take a solution of iron and add it to a solution of this yellow salt—this prussiate of potash—it will be converted into a beautiful blue substance. This is Prussian blue—Berlin blue; and it is the base of all the blues that are known by that name, and the base of many other colours also. What is this Prussian blue? Why, it is a ferro-cyanide of iron. We displace the potassium by the addition of the iron, and thus form this important dyeing material. This is obtained, then, from waste made up of the sweepings of our manufactories, the refuse of our slaughter-houses, and blood and filth of all kinds. Man comes in, you see, as creator, builds up the elements, and makes all these beautiful colours with which he dyes his silk, and makes blues for his calicoes and other materials. The Prussian blue is also mixed with flocks, and is used as a pigment, being extensively employed wherever a blue colour is an object.

Now, there are many other things which I might speak of in connection with this large subject. I might show you that some materials which look unlikely to be employed in the arts for any useful purposes, have been employed in that way. Recently there has been an attempt to use the substance which we know by the name of guano. We bring it over to this country on account of the phosphates which it contains. A series of beautiful colours have been obtained from this guano. If we take a little of it and mix it with nitric acid, we shall find that it will produce the beautiful colour of murexide. In the South Kensington Museum there is a series of colours which have been manufactured from guano. A few years ago, the test of the action of nitric acid upon the substances contained in guano was merely an amusement or chemical test; nobody ever thought of using it in the arts. But now, these substances are manufactured in large quantities, and guano is used successfully in the arts.

These beautiful colours do not, however depend on the phosphates of the guano, but upon the lithate of ammonia. When we add nitric acid to this substance, the purpurate of ammonia, or murexide, is produced. According to the way in which the guano is heated, will be the variety of results obtained. This is just one of a hundred applications of chemical knowledge to substances having a similar nature to guano.

I was asked the other day whether I had ever seen the colouring matter produced from an insect (*Cimex lectularius*) uncommonly disliked in this country. Some one in Australia, it was stated, had taken out a patent for procuring a beautiful colouring substance from this little creature. And if this should be the case, there is no doubt that they would run the hazard of extermination. I do not know whether this process has succeeded, but it illustrates the fact that there are hundreds of common things around us which may be made useful by the application of industry and intelligence.

Speaking of insects and their products, I must here remind you that to the insect tribe we are indebted for chloroform—one of the most powerful agents in alleviating human pain. The little ant contains a substance called formic acid, about which old John Ray and Martin Lister corresponded a century ago; and they found that it contained an acid; and so it got into books as formic acid. It was found to be composed of a compound radical, formyle, and three atoms of oxygen. Dumas substituted chlorine for the oxygen, and thus obtained terchloride of formyle, which is chloroform. Then the Americans found that ether was capable of taking away all sensation from the human body; and Dr. Simpson, of Edinburgh, found that terchloride of formyle was more thoroughly adapted for this purpose than even ether. All this has arisen from a study of the habits of insects. There is no telling but that every insect has some use in relation to man. Such facts are inducements to study. Be not dismayed by obtaining no immediate results. Surely it is some reward, even if we do not get money payment, to feel that we have not lived in vain; that we have exerted our brains to the utmost to fulfil the mission that God sent us to perform on this earth; and that we have left the world wiser and better for our work in it. But you may be assured some people will get the money. You and I are the better for rich men. These large capitalists are not keeping the money in their pockets: they are spending it in a variety of ways. It is the wildest of theories to think rich men are an injury to the poor: they better the poor man. Then let us help the men

to get rich seeing that they cannot deprive us of the blessings of intellectual research and exertion.

But here I must cease my illustrations from the insect kingdom. The subject is a large one, and I hope some day again to bring it before you. I have before said there is no part of an animal which is not of use. So when they are dead, they ought not to be buried or cast away. I wish here to illustrate the whole subject of the uses of dead animals by this diagram, drawn up by Dr. Playfair, which gives you the value and uses of a dead horse. The value is not a large

Value of a Dead Horse, from 20s. *to* 60s.: *Average value,* 40s.

Weight in pounds, from 672 *to* 1,138; *Average weight in pounds,* 950.

	WEIG'T	VALUE.	USES.
	lbs.		
Hair	1½	8*d.* to 1*s.* per lb.	Hair-cloth, mattresses, plumes, and bags for crushing seed in oil mills.
Hide	30	About 8*s.*	Leather.
Tendons	6	....	Glue and gelatine.
Flesh, boiled	224	1*l.* 8*s.*	Meat for men, dogs, and poultry.
Blood	60	....	Prussiate of potash, and manures.
Heart & Tongue	....	....	A mystery.
Intestines	80	....	Covering sausages and the like
Fat	20	3*s.* 4*d.*	Used for lamps after distillation.
Bones	160	4*s.* 6*d.* per cwt.	Knife handles, phosphorus, super-phosphate of lime, bone dust.
Hoofs	6	8*s.* to 10*s.* per cwt.	Buttons, gelatine, prussiates and snuff boxes.
Shoes	5	5*s.* to 10*s.* per cwt.	Shots and old iron.

sum,—from 20s. to 60s. on an average; but recollect that every application to art or science of this dead horse renders him of greater value; and it is for us, engaged in various ways in the arts of life, to see whether we cannot apply things that have hitherto been wasted. Five hundred horses die every week in London. The hair, you see, is worth from 8d. to 1s. per lb., and it is used for making hair-cloth, for stuffing mattresses, and making plumes, and bags for crushing seed in oil-mills. Then the hide, weighing 30 lbs., is worth 8s., which is perhaps not a great deal of money; but when you have from 300 to 500 a week dying within a radius of five miles from Charing Cross, it comes to some money. Then the skin is used for a variety of purposes; tendons you know may be made into gelatine, and glue, and jellies. I told you that you must not be particular about these jellies: when the poor old horse has drawn your carriage, served you in omnibus and cab, and died at last; even then you have not done with him, for his tendons may then serve you for your delicious jellies. Then again it is not an uncommon thing for man to eat horse-flesh. We do not eat it here knowingly, but they eat it on the continent of Europe. There is a story of a Frenchman, who thought we sold meat for almost nothing, for we sold it on skewers for a penny a skewer-full. Then there is the blood, which is carried to the prussiate of potash manufacturers. Then there are the internal tubes, which are used for the coverings of sausages; and, as I said of the jellies, we need not ask any questions about these coverings as long as they are sweet. The heart and tongue are evidently great "mysteries," for no one knows what is done with them. There is almost as much mystery about them as about the manufacture of the cloth of your coat. The heart, however, can be chopped up and mixed with sausage meat, and the tongues may be sold for ox-tongues. On a recent occasion, when I stated this fact, a newspaper which reported my lecture added that it was all a mistake, and that the tongues were never sold for so inferior an article as ox-tongue: they were always sold as reindeer tongues. Now, passing over the fat, which is worth 3s. 4d., I need not tell you that horses' bones are as good as any other bones, and can be employed for the various purposes to which other bones are applied. The bones of a horse weigh about 160 lbs., and are worth 4s. 6d. per cwt. Then there are the hoofs, 6 lbs. of these, at 8s. to 10s. per cwt., which can be used for making buttons, prussiates, and snuff-boxes. I do not think that it is correct to say they are used in making glue. I think horses' hoofs are composed of the same material as hair. They are sold, it is true to the glue-maker, but he sells them to the prussiate manufacturer. Even the poor old shoes are worth from 5s. to 10s. per cwt.; and even with regard to all these substances employed, there is nothing which cannot be used again and again.

Miscellaneous.

The Adulteration of Butter.

In order to distinguish between pure butter and that adulterated with lard and other substances, proceed thus:—First satisfy yourself, by melting a portion of the suspected butter over a water-bath, and observing if there be any insoluble admixture of farinaceous matter, such as wheat-flour, potato-starch, arrow-root, or turmeric, (said to be sometimes used,) which the microscope and chemical tests will prove; then mix the melted butter in an evaporating dish with four or five times its bulk of hot water, and allow it to stand for two or three hours to collect on the surface and solidify. Detach the resulting cake of butter, and place it on a piece of blotting-paper to dry, by the absorption of all adhering aqueous matter. If a piece of this prepared butter be introduced into a wide-mouth stoppered bottle, and surrounded with ether, at the temperature of 65° Fah., it ought to entirely dissolve, forming a clear lemon-yellow coloured liquid.

On the other hand, the purest lard, which, on being melted, leaves no residue, is more or less insoluble in ether, at that temperature, as a thick milky fluid results, which, on standing, deposits to a considerable extent. The same may be said of other fats, such as dripping, mutton-suet, tallow, &c., the precipitates from which are of a much coarser and flocculent character than that from lard in ether. Hence we perceive there is a striking peculiarity about butter, which, if treated as above, enables us to readily determine its purity and the probable proportion of foreign fatty matters mixed with it. The solution of lard and other fats in ether is considerably influenced by temperature, for if the bottle containing them be held in the hand a short time, liquefaction takes place, but on a reduction of temperature they are again precipitated. The character also of the various precipitates is remarkable, and gives us some clue to their nature,—the precipitate from lard being very fine and smooth, whilst that of dripping is granular and crystalline, and that from tallow long and thread-like, laying piled up one above the other. A solution of butter in ether, exposed to a less temperature than stated, yields beautiful stellar-like tufts of very fine acicular crystals.—*J. Horsley.*

Burning Oil Wells.

An oil well on fire is thus described in the *Tittsville* (Pennsylvania) *Gazette:*—"A dense black cloud of smoke was distinctly to be seen as the hill-tops were reached on leaving town. That cloud increased as the well was neared, until seen from the top of the hills adjoining the valley where the well was located, when the black column of smoke appeared, up which angry and lurid flames could be seen constantly leaping and flapping about, as though endeavoring to lash themselves into greater fury. The flames rose sixty to eighty feet into the air, and the noise of the flame, and the oil, and gas rushing from the pipe, was distinctly heard three-fourths of a mile. The stream of oil, the full size of the pipe, (four inches in diameter,) was thrown fifteen to thirty feet high, and all on fire the instant it left the pipe. Drops of oil thrown off a lurid blaze, and drops of water, converted into steam, were flying in every direction. Spiral columns of flame, formed by currents of air, rose on every side, and in great fury, presenting a most unique spectacle. The scene was grand, and one long to be remembered."

The Electric Light in Paris.

The experiments with the electric light, which have now been made for a long time past at the Palais-Royal, Paris, are still continued every evening with increasing success. Lately, instead of two burners fed by divided currents from the magneto-electric machine, one burner, fed by a single current has been used. It is raised sixteen metres, and illuminates, as with the light of the full moon, the whole square in front of the Palais-Royal and the two entrances of Rue Saint Honoré. Two hyperbolic reflectors—one above the light, the other below—increase and diffuse the light. By certain improvements in the prisms or cylinders of artificial carbon, which are used in the production of the light, M. Curmer, is now able to make electric lamps which will burn five or six hours without requiring any attention. The lamp of M. Serrin, placed before the house of Prince Eugene, also burns brilliantly. M. Serrin has succeeded lately in causing his lamp to burn under water almost as well as in the atmosphere. Thus, we may now light the bottoms of rivers, or of the sea, or the bottoms of floating vessels, sunken wrecks, the foundations of piers, and other submarine structures. It is expected that we shall soon be able to apply this method of illumination in our lighthouses, ships, and generally on land in our cities and houses. At the Invalides lately, in the presence of Despretz, Babinet, Foucault, and others, a magneto-electric machine was worked by one of Lenoir's lately-invented gas-engines, of 3 horse-power. By this means, a strong electric current was generated, and M. Serrin's lamp gave a very brilliant light equal to two hundred Carcel burners.—*London Mechanics' Magazine.*

Properties of Flint or Silica.

It is well known that silica can, by appropriate means. be obtained in the form of a pure aqueous solution, and it was to this liquid that we accordingly directed our attention. This solution can be made in several ways:—

1. By disolving sulphide of silicium in water, when sulphuretted hydrogen is given off, and the silica remains completely dissolved, and in such quantity that the liquid gelatinises when an attempt is made to evaporate it.

2. By precipitating silica in the gelatinous state from an alkaline silicate, by means of acetic or other weak acid, and, after well washing, heating it for some time under pressure, with a small quantity of water in a closed vessel. A liquid is thus obtained which gelatinises on addition of a saline solution.

3. By passing gaseous fluoride of silicium over crystallised boracic acid, and separating the hydrofluoric and boracic acids by digestion with a large excess of ammonia, a hydrate of silica remains, which, when well washed from the above acids, is very soluble in water. This solution gives no precipitate when boiled but leaves silica as an insoluble powder on evaporation.

4. By the beautiful method recently pointed out by Professor Graham, in which advantage is taken of the new means of separating bodies by *dialysis.* A solution of silicate of soda, supersaturated with hydrochloric acid, is placed on one side of a parchment paper septum, pure water being on the other side; in a few days the hydrochloric acid and chloride of sodium will be found to have completely passed through the diaphragm, leaving the silica in aqueous solution, and so pure that acid nitrate of silver fails to detect chlorine in the liquid. This solution remains fluid for some days, but it ultimately gelatinises. We have generally adopted this last plan of preparing the aqueous solution of silica, although a stronger solution is obtained by the method first given.

When a pure aqueous solution of silicic acid prepared as above is allowed to soak into the pores of chalk or dolomite, a process of hardening rapidly occurs, which goes on increasing for several days, whilst, owing to its considerable depth of penetration, and to there being no soluble or efflorescent compounds to be removed, there is every probability that this hard silicious impregnation will afford permanent protection to the stone. We are now actively engaged in investigating the nature of the action which takes place, and already several curious and important results have been made out, from which we are led to anticipate that our experiments will ultimately be rewarded with complete success.—*Chemical News.*

Solder for Brass Instruments.

An alloy of 78.26 parts of brass, 17.41 of zinc, and 4.33 of silver, with the addition of a little chloride of potassium to the borax, is recommended by Mr. Appelbaum, as the best solder for brass tubes which have to undergo much hammering or drawing after joining.

Photo-Electric Apparatus.

A Trappist named Delalot-Sevin, of the abbaye de la Grace-Dieu, has invented a new pile, much stronger, and at the same time much cheaper, than the pile of Bunsen. By means of his photo-electric apparatus he produces an electric light as cheap as gas, and with his thermo-electric pile he supplies caloric on economic terms hitherto unknown. Several of these apparatus have been constructed, and one is at full work in the abbaye of La Grâce-Dieu. Manufactories for the public are shortly to be established in Paris and at Lyons. The apparatus for producing gas will not be given to the public until after the Exhibition at London next year, but that for heating buildings will be made public on the 16th of December next. The inventor has been authorized to make public experiments with his system of lighting on the Place Saint Jacques in Paris, and on the Place Bellecourt at Lyons.

On the Natural Dissemination of Gold.

Mr. Eckfeldt, the principal assayist for the United States Mint at Philadelphia, has lately made several interesting examinations tending to show the very wide distribution of gold. Passing over the evidence respecting its presence in various galenas, in metallic lead, copper, silver, antimony, &c., we recite the following, perhaps the most curious result of all:—Underneath the paved city of Philadelphia there lies a deposit of clay, whose area, by a probable estimate, would measure over three miles square, enabling us to figure out the convenient sum of ten square miles. The average depth

is believed to be not less than fifteen feet. The inquiry was started whether gold was diffused in this earthy bed. From a central locality, which might afford a fair assay for the whole, the cellar of the new market house in Market Street, near Eleventh Street, we dug out some of the clay at a depth of fourteen feet, where it could not have been an artificial deposit. The weight of 130 grammes was dried and duly treated, and yielded one-eighth of a milligramme of gold; a very decided quantity on a fine assay balance. It was afterwards ascertained that the clay in its natural moisture loses about fifteen per cent. by drying. So that, as it lies in the ground, the clay contains one part gold in 1,224,000. This experiment was repeated upon clay taken from a brickyard in the suburbs of the city, with nearly the same result. In order to calculate with some accuracy the value of this body of wealth, we cut out blocks of clay, and found that, on an average, a cubic foot as it lies in the ground, weighs 120 pounds, as near as may be; making the specific gravity 1.92. The assay gives seven-tenths of a grain, say three cents' worth of gold to the cubic foot. Assuming the data already given, we get 4,180 millions of cubic feet of clay under our streets and houses, in which securely lies 126 millions of dollars. And if, as is pretty certain, the corporate limits of the city would afford eight times this bulk of clay; we have more gold than has yet been brought, according to the statistics, from California and Australia. It is also apparent that every time a cartload of clay is hauled out of a cellar, enough gold goes with it to pay for the carting. And if the bricks which front our houses could have brought to their surface, in the form of gold leaf, the amount of gold which they contain, we should have the glittering show of two square inches on every brick.

Microscopic Photography.

Professor Gerlach, of the University of Erlangen, has obtained some photographs of microscopic objects by a new method, which consists in taking the object itself as the negative image, and then taking a magnified positive of this image, and repeating the operation, alternately positive and negative until an image is obtained of such a size as to present details of structure far exceeding in magnitude those obtainable by the most powerful microscopes at present in use.

The Electricity of the Torpedo.

M. Armand Moreau has informed the French Academy that he has at length succeeded in collecting and condensing this electricity, by taking extreme care in insulating the body of the animal, and only bringing it in contact with the condenser at the moment when, the nerve being excited, the discharge takes place. Without these precautions the electricity is immediately conveyed to the earth. Thus it is that it is nearly impossible to collect spontaneous discharges, and that we can only succeed by provoking one.

TO INVENTORS AND PATENTEES IN CANADA.

Inventors and Patentees are requested to transmit to the Secretary of the Board short descriptive accounts of their respective inventions, with illustrative woodcuts, for insertion in this Journal. It is essential that the description should be concise and exact. Attention is invited to the continually increasing value which a descriptive public record of all Canadian inventions can scarcely fail to secure: but it must also be borne in mind, that the Editor will exercise his judgment in curtailing descriptions, if too long or not strictly appropriate; and such notices only will be inserted as are likely to be of value to the public.

TO CORRESPONDENTS.

Correspondents sending communications for insertion are particularly requested to write on one side only of half sheets or slips of paper. All communications relating to industry and Manufactures will receive careful attention and reply, and it is confidently hoped that this department will become one of the most valuable in the Journal.

TO MANUFACTURES & MECHANICS IN CANADA.

Statistics, hints, facts, and even theories are respectfully solicited. Manufacturers and Mechanics can afford useful coöperation by transmitting descriptive accounts of Local Industry, and suggestions as to the introduction of new branches, or the improvement and extension of old, in the localities where they reside.

TO PUBLISHERS AND AUTHORS.

Short reviews and notices of books suitable to Mechanics' Institutes will always have a place in the Journal, and the attention of publishers and authors is called to the excellent advertising medium it presents for works suitable to Public Libraries. A copy of a work it is desired should be noticed can be sent to the Secretary of the Board.